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# Journal of the Society of Arts.

FRIDAY, MARCH 5, 1858.

## COUNCIL.

The Council will be specially summoned, for Wednesday next, the 10th instant, at 6 o'clock, to consider—

1. Whether this Society should at once announce its intention to direct and superintend an Exhibition, in 1861, or any other year.

2. What should be the exact character of such an Exhibition.

3. Whether the surplus funds, if any, should be appropriated by the Society to the advancement of Arts, Manufactures, and Commerce.

## EXAMINATIONS, 1858.

In accordance with the new Bye-laws, the Council have had under consideration the appointment of the Board of Examiners. Having to nominate only one Examiner for each of the subjects included in the "Programme" for 1858, the Council have found themselves charged with the delicate and difficult duty of selecting less than a moiety of the names of those gentlemen who in the autumn of last year had liberally consented to serve gratuitously as Examiners this year.

The Council could not but feel that the Society was under much obligation to those gentlemen, many of whom had already given their valuable services gratuitously in former years; and it was a difficult but necessary duty to make the requisite selection.

The Council have now the pleasure to announce that the following gentlemen have been appointed the Board of Examiners for 1858 :—

|                   |                                                                |
|-------------------|----------------------------------------------------------------|
| Arithmetic.....   | { Rev. Alexander Wilson, M.A.,<br>National Society, London.    |
| Book-keeping..... | { John Ball, Esq., of the firm<br>of Messrs. Quilter and Ball. |

### MATHEMATICS.

|                      |                                                                                                                     |
|----------------------|---------------------------------------------------------------------------------------------------------------------|
| Algebra .....        | { Rev. Harvey Goodwin, M.A.,<br>Cambridge.                                                                          |
| Geometry .....       | { Rev. B. Morgan Cowie, M.A.,<br>Professor of Geometry at<br>Gresham College; one of<br>H.M. Inspectors of Schools. |
| Mensuration .....    | { William Spottiswoode, Esq.,<br>F.R.S.                                                                             |
| Trigonometry .....   |                                                                                                                     |
| Conic Sections ..... |                                                                                                                     |

### PHYSICS.

|                                            |                                                                                    |
|--------------------------------------------|------------------------------------------------------------------------------------|
| Navigation and Nautical<br>Astronomy ..... | { John Riddle, Esq., M.A.,<br>Head Master of the Nauti-<br>cal Schools, Greenwich. |
|--------------------------------------------|------------------------------------------------------------------------------------|

|                                            |                                                                                                      |
|--------------------------------------------|------------------------------------------------------------------------------------------------------|
| Statics, Dynamics, Hy-<br>drostatics ..... | { Rev. A. Bath Power, M.A.,<br>Principal of the Diocesan<br>Training School, Norwich.                |
| Practical Mechanics .....                  |                                                                                                      |
| Magnetism, Electricity,<br>and Heat.....   | { Charles Brooke, Esq., M.A.,<br>F.R.S., Surgeon to the West-<br>minster Hospital.                   |
| Astronomy .....                            | { Rev. Baden Powell, M.A.,<br>Savilian Professor of Mathe-<br>matics in the University of<br>Oxford. |
| Chemistry .....                            | { Dr. A. W. Williamson, Pro-<br>fessor of Chemistry, Univer-<br>sity College, London.                |
| Animal Physiology .....                    | { William Sharpey, Esq., M.D.,<br>F.R.S., Examiner in Uni-<br>versity College, London.               |
| Botany .....                               | { Arthur Henfrey, Esq., F.R.S.,<br>Professor of Botany, King's<br>College, London.                   |
| Agriculture .....                          |                                                                                                      |
| Political and Social Eco-<br>nomy .....    | {                                                                                                    |
| Descriptive Geography...                   | William Hughes, Esq.                                                                                 |
| Physical Geography.....                    | { Rev. Samuel Clark, M.A.,<br>Principal of the Training<br>College, Battersea.                       |
| English History.....                       | { E. S. Creasy, Esq., Professor<br>of History, University Col-<br>lege, London.                      |
| English Literature .....                   | { Rev. F. Temple, M.A., Head<br>Master of Rugby School.                                              |
| Latin and Roman History                    | { F. R. Sandford, Esq., B.A.,<br>Assistant Secretary to the<br>Committee of Council on<br>Education. |
| French .....                               | { A. Mariette, Esq., Professor<br>of French, King's College,<br>London.                              |
| German .....                               | { Dr. Bernays, Professor of Ger-<br>man, King's College, Lon-<br>don.                                |
| Freehand Drawing .....                     | F. S. Cary, Esq.                                                                                     |
| Mechanical Drawing.....                    | { Thomas Bradley, Esq., M.A.,<br>Professor of Geometrical<br>Drawing, King's College,<br>London.     |

## FINANCIAL PRIZE ESSAY.

The following gentlemen have, at the request of the Council, undertaken the duty of adjudicating upon the merits of the Essays sent in for competition :—

|                                                                                      |
|--------------------------------------------------------------------------------------|
| John Towne Danson, Esq., Fellow of the Statistical Society.                          |
| C. Neate, Esq., M.A., Professor of Political Economy in the University of Oxford.    |
| Jacob Waley, Esq., M.A., Professor of Political Economy, University College, London. |

## TENTH ANNUAL EXHIBITION OF INVENTIONS.

Monday, the 5th of April, is fixed for the opening of the Society's Tenth Annual Exhibition of recent Inventions.

Persons intending to contribute to the Exhi-

bition should communicate with the Secretary of the Society of Arts as soon as possible, stating—

1. The title of the Invention.

2. Whether the article will be a Specimen, Model, or Drawing.

Articles for exhibition must be forwarded to the Society's House, Adelphi, London, W.C., *carriage paid*.

The days for receiving articles are, Thursday, the 18th; Friday, the 19th; and Saturday, the 20th of March; and no articles can be received after the last of these days.

All articles should be accompanied with a brief but clear description of the invention, with a wood-block (when possible) for illustrating the Catalogue, and a reference to any publication in which the Invention is described.

All drawings exhibited must be framed.

No charge whatever is made for space, and the Exhibition is free.

### ARTISTIC COPYRIGHT.

A Report as to the existing English Common and Statute Law, relative to this subject, has been prepared at the request of the Committee, by D. Robertson Blaine, Esq., Barrister-at-Law, Reporter to the Committee, and may be obtained of the Society's publishers, Messrs. Bell and Daldy, Fleet-street. Price Sixpence.

### SPECIAL PRIZE.

A Prize of Twenty Pounds (placed at the disposal of the Council for this purpose by the Rev. F. Trench and J. MacGregor, Esq.,) and the Society's Silver Medal, is offered for a Writing-case suited for the use of Soldiers, Sailors, Emigrants, &c. The attention of those intending to compete for this prize is directed to the following points, which will influence the Council in making their award :—

Lightness,  
Smallness of size,  
The avoidance (if possible) of fluid ink,  
Durability,  
Cheapness, with a guaranteed supply, and  
General applicability to the duties, habits, and requirements of the above classes.

The articles sent in for competition must be delivered at the Society's House, Adelphi, London, W.C., on or before the 8th May next.

### EXAMINATION PRIZE FUND FOR 1858.

The following circular letter has been addressed to the Members of the Society :—

Society for the Encouragement of Arts, Manufactures, and Commerce, Adelphi, London, W.C., Jan. 30, 1858.

Sir,—I am instructed by the Council to inform you that the Examination Prize Fund for 1858 is now opened. The donations for 1857 were contributed by twenty-

three Members, and there is a small balance to carry forward.

The Council draw attention to the fact, that last year's Examinations were limited to two centres. At these two centres, pupils from thirty-seven Institutions only presented themselves; ten of them were from the metropolitan district, London being one centre; sixteen from Yorkshire, Huddersfield being the second centre, leaving but eleven for all England, Ireland, Scotland, and Wales. This unequal distribution was one of the reasons which satisfied the Council that the system was not adapted to meet the wants of all the Institutions. They, therefore, resolved to bring the Examinations to the very doors of the Institutions, by such step of course throwing open the prize fund to the students of every Institution.

The Council have also decided on contributing a certain mileage towards the travelling expenses of those candidates who desire to receive personally and publicly their prizes, and also £5 towards the travelling expenses of each pupil, who, obtaining three of the Society's certificates of the first class in the subjects contained in the Oxford programme, is desirous to contend for the degree of Associate at the Oxford Examinations. These changes lead the Council to believe that a considerably larger sum than last year will be required for the prizes, and I am, therefore, instructed to draw the attention of all the members to the circumstances.

Donations can be remitted to Mr. Samuel Thomas Davenport, Financial Officer, Society of Arts, Adelphi, London, to whom Post-office Orders should be made payable.

I am, Sir, your obedient servant,

P. LE NEVE FOSTER, Secretary.

The following is the list of Donations up to the present date :—

|                                                                             |       |
|-----------------------------------------------------------------------------|-------|
| T. D. Acland, Member of Council.....                                        | £ 5 5 |
| John Ames.....                                                              | 5 5   |
| J. G. Appold, Auditor.....                                                  | 10 10 |
| T. H. Bastard.....                                                          | 5 0   |
| R. L. Chance.....                                                           | 5 5   |
| Harry Chester, Vice-Pres.....                                               | 10 10 |
| Henry Cole, C.B., Vice-Pres.....                                            | 1 0   |
| C. Wentworth Dilke, Vice-Pres. Chairman<br>of Council (third donation)..... | 10 10 |
| Thomas Dixon.....                                                           | 1 1   |
| Lieut.-Col. F. Eardley Wilmot, R.A.....                                     | 5 0   |
| Lord Ebury.....                                                             | 5 0   |
| J. Griffith Frith, Member of Council.....                                   | 5 5   |
| J. W. Gilbert, F.R.S., Treasurer (second<br>donation).....                  | 10 10 |
| F. Seymour Haden (annual).....                                              | 2 2   |
| William Hawksworth.....                                                     | 1 1   |
| Edward Highton (annual).....                                                | 2 2   |
| James Holmes (annual).....                                                  | 1 1   |
| The Marquis of Lansdowne, Vice-Pres.....                                    | 20 0  |
| George Lowe, F.R.S.....                                                     | 1 1   |
| The Master of the Mint, Member of Coun-<br>cil (second donation).....       | 10 10 |
| Sir Thomas Phillips, Member of Council...                                   | 5 5   |
| William T. Radford.....                                                     | 1 1   |
| Charles Ratcliff, Hon. Local Sec. (annual)...                               | 10 10 |
| Arthur Trevelyan.....                                                       | 1 0   |
| T. Twining, jun., Vice-Pres.....                                            | 10 10 |
| Dr. J. Forbes Watson.....                                                   | 1 1   |
| G. F. Wilson, F.R.S., Member of Council<br>(third donation).....            | 10 10 |

### THE PATENT OFFICE.

The following Memorial is about to be presented to the Commissioners of Patents, and will lie at the Society's house for a few days, for receiving the signatures of members :—

*To the Right Honourable Frederick, Lord Chelmsford, Lord High Chancellor of Great Britain; the Right Honourable Sir John Romilly, Master of the Rolls; Sir Fitzroy Kelly, Her Majesty's Attorney-General; and Sir Hugh McCalmont Cairns, Her Majesty's Solicitor-General.*

The Memorial of the undersigned Members of the Council and Members of the Society for the Encouragement of Arts, Manufactures, and Commerce,

Humbly Sheweth,—That it appears to your Memorialists that a largely increased accommodation is urgently required for the numerous inventors, engineers, and others, who daily consult the official documents and valuable Free Library of the Great Seal Patent Office, and who desire to inspect the instructive models collected by the Superintendent of Specifications, to which additions have been continually offered from all parts of the United Kingdom.

That although recent alterations in the Laws affecting Patents have stimulated inquiries in every branch of knowledge connected with Industrial Arts, and the publications of the Commissioners have largely facilitated such investigations, yet the full benefit of these excellent measures cannot be realised so long as only the present small apartments are devoted to this national undertaking.

That the present Library is the only one in the United Kingdom in which the public have free access, not only to the Records of the Patents and Inventions of this Country, but also to the Official and other Documents relating to Inventions, contributed by numerous Foreign Governments, who have liberally responded to the desire of the Commissioners to promote international relations for the improvement of Manufactures, by the encouragement of Invention.

That it cannot but be a matter of regret that, while a surplus, already large, is continually accruing from the fees paid for Patents in this country, the buildings devoted to the purposes of the Patent Office are insufficient in themselves, and contrast most unfavourably with those of Foreign States.

Your Memorialists, therefore, pray that you will be pleased to take such steps as may seem to you advisable for the erection and maintenance of a commodious Patent Office worthy of this country, and where ready access may be had to a Library, Reading-room, and Museum, furnished with the papers, books, and models indispensable to the right direction and advance of British Industry.

### THIRTEENTH ORDINARY MEETING.

WEDNESDAY, MARCH 3, 1858.

The Thirteenth Ordinary Meeting of the One Hundred and Fourth Session, was held on Wednesday, the 3rd inst., Henry Cole, Esq., C.B., Vice-President, in the chair.

The following Candidates were balloted for and duly elected members of the Society :—

Ashworth, Henry  
Behnes, William  
Hewett, John

Jones, Thomas Mayhew  
West, Walter  
Westmacott, Richard, R.A.

The Drawings by W. Mulready, R.A., the result of the Mulready Exhibition of 1848, were exhibited, and the Chairman made the following observations in reference to them :—

The idea of establishing a National Gallery of British Art, was first specially fostered by the Society of Arts.

In the year 1847, the public possessed only those few pictures of the British School which had been purchased

with Mr. Angerstein's collection of pictures. British pictures, indeed, at that time, in the judgment of the great connoisseurs, ranked very much below second or third rate Italian pictures. At a meeting held in February, 1847, a proposal was made to this Society, which always has the courage to be in advance of public opinion, to assist in forming a National Gallery of British Art, and the paper embodying the idea was read and discussed, and may be found printed in the volume of Transactions for the year.

It was suggested that an annual Exhibition should take place of the works of some eminent living artist, and that any profits which might result from this exhibition, together with any special donations, should be applied in purchasing some work or works of the artist whose productions were exhibited, and that these works should be presented to the National Gallery as a means of founding a Gallery of British Art, and thus vindicating the rights of National Art to be duly recognised in a National Collection.

An exhibition accordingly took place of the works of William Mulready, in the year 1848, and a small surplus of £240 was obtained, which, having been paid to Mr. Mulready, he, in return, has presented to the Society three of his remarkable drawings, two in chalks and one in pen and ink, which the Council have accepted, and have offered them to the trustees of the National Gallery in accordance with the original proposal. Previous to accepting the drawings offered by Mr. Mulready, the Council referred the matter to a Committee to report to them on accepting the works submitted. That Committee consisted of the following gentlemen :—Sir Charles Eastlake, P.R.A., Mr. John Bell, Mr. F. S. Cary, Mr. J. C. Horsley, A.R.A., Mr. R. Redgrave, R.A., Mr. D. Mac-lise, R.A., Mr. S. Haden, Mr. W. Hawes, Mr. S. Hart, R.A., Mr. S. Hickson, Mr. David Roberts, R.A., Sir J. P. Boileau, Bart., Mr. J. Thompson, Mr. C. Wentworth Dilke, Mr. H. Cole. That Committee reported as follows:

"The Committee have carefully examined the drawings liberally offered by Mr. Mulready, and are unanimously of opinion that as studies which have been rarely equalled in ancient or modern times, they are well worthy of the acceptance of the Council, with the view of offering them to the trustees of the National Gallery.

"Considering the number of pictures by Mr. Mulready, which the nation now possesses, the Committee are of opinion that he has shown sound judgment in offering drawings which exhibit the successful use of chalks as well as what may be done by the pen in the hands of an accomplished artist."

Mr. Etty's pictures formed the second exhibition, which hardly paid its expenses, and the further prosecution of the idea was dropped, because a National Gallery of British Art was being formed by other means.

In 1847, a few months after the idea thus nurtured by the Society had been suggested, Mr. Vernon gave his pictures to the nation.

Some time before Mr. Vernon's gift was made, Mr. Sheepshanks had stated generally to his friends that he proposed to give his pictures to the country, and Mr. Sheepshanks consulted Mr. Vernon on the expediency of making a joint gift of their separate collections of pictures, coupling with it the condition that the government should first provide a suitable building to receive them. Unfortunately for the exhibition of the pictures, Mr. Vernon preferred to stand alone, and declined to co-operate with Mr. Sheepshanks, and his pictures, having first been concealed in the basement of the *National Gallery*, have been for years only a little less invisible on the ground-floor of Marlborough-house.

Owing to his foresight, Mr. Sheepshank's pictures have been well-housed and are seen, even far away in the wilds of Kensington, by greater numbers in a corresponding period than visit Mr. Vernon's dimly-lighted pictures at Marlborough-house. Turner, too, has given his magnificent collection to the country. The effects of the Lawrence

bequest will also tell in forming a British Gallery, and the idea of a British Gallery of Art, which the Society thought it right to cherish in 1847, seems likely to grow to such dimensions as to require some new mode of treating it.

As the treasures of Art accumulate, common sense suggests that they should not be allowed to form an overgrown wearisome centralized collection, located only in one spot of the metropolis, but that the finest specimens should be chosen for the central gallery, and that the whole country should enjoy the means of borrowing the surplus. Encourage the provision of suitable buildings for exhibiting pictures and works of Art, not merely in the metropolis, with its three millions of people, spreading over a diameter of twelve miles, but over the whole kingdom, and circulate the superfluous pictures from local gallery to local gallery. The State, with local co-operation, would then do with National pictures that which the wealthy have been accustomed to do with their own pictures with safety at the British Institution for more than half a century.

If the Vernon, Turner, and Sheepshanks pictures were all collected together, a noble gallery of British Art would be formed, and at least half the whole number of pictures would be available for circulation over the whole kingdom. Mr. Sheepshanks' gift provides for such a distribution. The Treasury and trustees of the National Gallery have full powers over the Turner bequest, but an Act of Parliament would be necessary to render the superfluous Vernon pictures generally useful. This principle of distribution is already in full operation with works of Ornamental Art belonging to the Kensington Museum. Every local School of Art is privileged to borrow whatever is portable, and experience has shown that even Venetian glass and precious Majolica may be safely circulated. A thousand pieces were sent to the Manchester Art Treasures Exhibition, and not a single accident took place. The distribution of pictures would be all the easier, and might be managed with the least possible risk.

Should this suggestion of circulating works of art be acceptable to the public, it may be hoped that these Mulready drawings may assist in giving some practical direction to it.

The Paper read was :—

#### ON THE PROGRESS OF THE ENGLISH LIGHTHOUSE SYSTEM.

By A. G. FINDLAY.

It is now ten years since I had great pleasure in drawing the attention of the Society of Arts to the Lighthouse system of our country, a system which, viewed in relation either to its utility, or to the beauty and excellence of its details, is worthy of the highest admiration of a nation which boasts of its maritime superiority. Yet, at the period I allude to, the beautiful appliances of science, the results of profound investigation therein, were but imperfectly understood or appreciated by those unconnected with it, and there was no work which embodied the description and pointed out the utility of our lighthouses.

In the paper above referred to, which is printed in the Society's Transactions for 1847-8, and in the excellent account of the Skerryvore Lighthouse, by Alan Stevenson, Esq., which appeared soon afterwards, the main features of the system, as then existing, are detailed.

The period which has since elapsed has not been unimportant, either in the improvements of lighthouses, or, in what is of more consequence, their requirements. It is proposed to treat of both these topics in the present paper. But before entering into the details of either of these two branches of our subject, some brief recapitulation of my previous account may be necessary, in order to put the present meeting in possession

of the main facts concerning pharology. Thus this, like my former paper, will bear somewhat of an historical character, which it is thought will be best to develop the plan of the existing position and requirements of a lighthouse.

First as to the illumination. There are two systems now employed; the older one of lamps with metallic reflectors placed behind the light, the catoptric, or as it may be called the English system, and the other where the light is controlled by lenses placed before it, or the dioptric, known as the Fresnel or lenticular system, which was first brought into general use in France.

The merit of priority in the former undoubtedly belongs to England. Polished metallic reflectors were invented in England, and first used at the Liverpool lighthouses. Of late the credit of the invention has been given to Chevalier Borda, who, with the assistance of M. Lenoir, constructed some reflectors of silvered copper for the famous Cordouan lighthouse, off the mouth of the Gironde, in the year 1780.

M. de Teulère, a member of the Royal Corps of Engineers of Bridges and Roads in France, has also been considered by some as the first to have directed attention to the utility of paraboloidal reflectors, and is said to have proposed a revolving reflector light for the Cordouan, in 1783. But in re-affirming the statement made on pages 287 and 288 of the Proceedings of the Society, before referred to, that William Hutchinson, mariner and dock-master of Liverpool, invented and used metallic reflectors at that port prior to 1777, and most probably in 1763, an anecdote which I have met with adds to the certainty of the early date of the invention.

It is stated that William Hutchinson, in the year 1763, laid a wager, which he won, that he would read from a book, at the distance of 200 feet, by the light of a farthing candle. He did this with the aid of one of the Liverpool Lighthouse reflectors.

The reflectors used in the Liverpool lighthouses at the period alluded to, were formed on a parabolic curve of 1, 2, and 3 feet focus, and 3, 5½, 7½, and 12 feet in diameter, the smaller ones of tin plates soldered together, and the larger of wood, covered with looking-glass. The lamps consisted of flat wicks of from 3 to 14 inches broad, the supply of oil being kept uniform by a dripping-pot behind the reflector, as shown in the diagram. These and more perfect reflectors are described in Hutchinson's excellent work entitled "A Treatise on Practical Seamanship," and published in 1777. Mr. A. Stevenson, quoting a second edition of the same work, published in 1791, under a different title, running thus: "A Treatise, &c., on the best form of Merchant Ships, &c.," has been led to give the priority to the French.

The next advance in the economising of light was that made by Mr. Thomas Smith, the engineer to the Scottish Lighthouse Board, who, in 1786, introduced the reflector which I have the pleasure to exhibit. It is formed of a hollow paraboloidal mould of plaster, lined with facets of mirror glass. Mr. Smith originated this idea himself, without being aware of what had been done at Liverpool and in France previously. These contrivances were in use prior to Argand's invention of the tubular wick lamp, which was a great step in the art of illumination. The first polished metal reflectors used in Great Britain, were placed in the Inch Keith lighthouse in 1803.

As far as the principle is concerned, the catoptric system was perfect when Captain Huddart determined the best form for the parabolic curve of these reflectors, and his principle is still in use. To clearly understand the action of these reflectors, a reference to the diagram will be sufficient; it will be seen that the form of the curve is such that, a line or ray from the focus striking any point of the inner face of the parabola, will do so at the same angle as that of a horizontal ray reflected from that point; therefore all rays of light, so reflected, will pass off in a horizontal direction; and, supposing that the light was a single point,

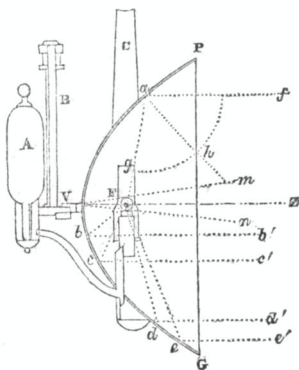
the reflector would send forth a cylinder of rays equal in diameter to its double ordinate, or the diameter of its mouth, consequently it would be impossible to show a light all round the horizon with any number of such instruments; but, as the flame of the lamp is about one inch in diameter, this subtends an angle of 14 deg. 22 min., at the vertex of the parabola, of 4 inches focus, (the usual size of lighthouse reflectors); this, with other circumstances, makes it necessary to use from 25 to 33 such reflectors to form a complete zone of light.\*

The catoptric system is still in use in the majority of our lighthouses, as it possesses some advantages over the dioptric system, as will be seen presently.

The dioptric or lenticular system, like that of the reflectors, has arisen, step by step, to its present condition. The great size which a lens must be to control any great volume of light, would require such a mass of material that many conditions render the ordinary convex lens inapplicable to the purpose. The general plan of the lens as now used, was suggested as a good form of burning glass by Buffon, in 1773. For lighthouse purposes the form now applied was first proposed in Britain, by Sir David Brewster, in 1811, who showed that a lens might be built up of separate pieces to any size. Previous to this, in 1780, the Abbé Rochon ground down a light piece of glass to concentric rings, and a similar lens was made by Messrs. Cookson, of Newcastle-upon-Tyne, for the Northern Lighthouse Board. The great trouble and difficulty attending the construction of such lenses precluded their general use.

In the year 1819, M. Augustin Fresnel, without knowing what Sir David Brewster had done in England, proposed a polyzonal lens of the same character, and afterwards, in conjunction with MM. Arago and Mathieu, applied the system to the Cordouan lighthouse. The new apparatus was first shown on July 23, 1823. M. Augustin Fresnel subsequently made the system

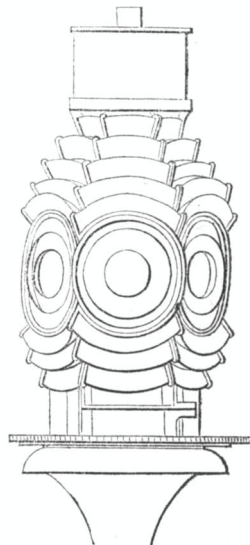
\* P V G is a vertical section of a reflector; F the focus and



situation of the flame of the lamp; A the oil fountain; C the ventilating tube. The angle of incidence being equal to the angle of reflection, the angle  $V a g$  at which the ray  $F g a$  falls on the surface of the parabola at the point  $a$  is equal to the angle  $P a f$ , at which it is reflected from the surface; therefore, the angle made by the ray falling on, and being reflected from, the surface, will be bisected or divided into two equal parts by the perpendicular to the tangent of the parabola at the point of incidence, therefore the angle  $g a f$  is bisected by  $g h m$ , that is, the angle  $g a h$  is equal to the angle  $h a f$ . The peculiar property of the parabolic curve is that the ray, when reflected from any point, is always thrown in a direction parallel to the axis of the curve; that is, the direction  $a f$  of the reflected ray is parallel to the axis  $F Z$ . Thus a copper reflector, lined with highly polished silver, formed to such a curve, with a mathematical point of light placed in its focus, as  $F$ , will reflect the rays from it in straight lines, parallel with its axis  $V Z$ , as  $F b b'$ ,  $F c c'$ ,  $F e e'$ , &c., and thus send forth a cylinder of light, whose diameter is equal to the double ordinate of the reflector, P G.

much more perfect, and hence it is generally called by his name.

The lenticular apparatus is placed around the single central lamp, as shown in the example I am enabled to exhibit. The arrangement of glass is so constructed as to refract the rays emitted from the lamp in the focus of the apparatus in every direction, into beams parallel with the horizon.



This apparatus is a holophotal fourth-order lens, showing a revolving light. The oil reservoir is placed over the apparatus, which consists of six polyzonal lenses around the flame of the lamp, above each of which are six portions of catadioptric rings, which are made concentric with the central portion, below which are three central rings. On the revolution of this machine each face sends forth a flash of nearly the whole light emitted by the lamp. I am indebted to Messrs. Wilkins and Co. for the opportunity of showing this apparatus.

It will be readily understood, that for an instrument of this character to perform its office, many conditions are necessary, first the glass, which is used in such large masses must possess perfect homogeneity, it must possess great transparency, and its figure must be formed with great accuracy to ensure successful operation. Its action may be briefly explained as follows, assisted by the illustrative diagram. A plano-convex lens of 30 inches diameter, as required in a first-order apparatus, would, if not formed on the polyzonal principle, be above 11 inches in thickness in the middle, a condition manifestly impracticable. The convex surface of the lens is, therefore, supposed to be cut into circular zones of triangular section, so that all the solid portion of the lens is dispensed with; these sectional zones are then arranged on one plane, and have the same refractive properties as if they were one solid piece, because the two surfaces are of the same relative figure.

For a revolving light, the lenses of the central portion of the apparatus are arranged into an octagonal prism which in the largest or first-order light is 6 feet  $\frac{1}{4}$  inch in diameter. For a fixed light the central part of the apparatus is formed of a band of lenses whose section is determined by the horizontal revolution of the figure of the polyzonal lens. This portion of a first-order light economises rather more than one-fourth of the whole light emitted by the lamp in its focus, or 92 deg. At first it was thought impossible to construct this central drum or belt of a circular form, and it was then made a polygon of thirty-two sides, but Messrs. Cookson, in 1836, constructed a circular one, which greatly increased the power and utility of the apparatus.

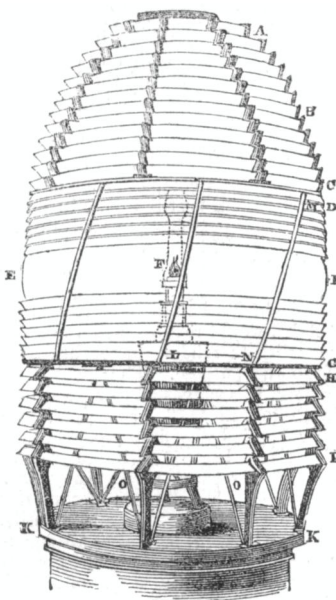
To control that portion of the emitted light which passes upwards over this central belt, and amounts to three-eighths of the whole quantity, the plan first adopted by Fresnel, was to place a series of small mirrors disposed in seven tiers gradually decreasing in diameter, forming a species of cupola above the central belt. These mirrors, strictly speaking, would be portions of such parabolas as would, if carried around the focus, form perfect reflectors, as may be comprehended from the diagram. In practice, however, owing to the breadth of the flame, they were formed of silvered plate glass, inserted into small brass frames, and suspended by screws at the back to an iron frame work. In revolving as well as fixed lights, this portion of the apparatus is fixed, and gives the continuous light visible between the flashes of a revolving light, which flashes are produced by making the eight polyzonal lenses revolve in a regular interval, and by this means the rays from the lamp being directed in eight directions, cause a bright flash to appear to the distant observer at intervals of one-eighth of the period occupied by the revolution of the entire apparatus.

The portion of light which escapes below this central belt was also economised by the same means; that is, four tiers of these mirrors were placed below, of equal diameter with the whole apparatus, and were constructed on the same principle. These arrangements affect about four-fifths of the entire amount of light, but in doing this there is the great loss caused by the absorption of light by metallic specula, which perhaps amounts to one-half of the whole incident light.

This last consideration led M. Fresnel to construct his small dioptric apparatus, with refracting and totally reflecting glass zones above and below the principal portion. The action of these zones may be familiarised by the use of the ordinary prism, which refracts the incident ray in one direction, and if it receives it on the inner surface of the opposite side at a greater angle than about 41 deg. 49 min., the ray is totally reflected, and ultimately emerges from the prism in a horizontal direction, the only loss of light being caused by the absorption by the glass. The first application of this principle on a large scale is due to the suggestions and calculations of Mr. Alan Stevenson, and it was first introduced in the noble Skerryvore light, which was completed on December 23, 1843, by M. François Soleil. "Nothing can be more beautiful," says Mr. Alan Stevenson, "than an entire apparatus for a fixed light of the first order. It consists of a central belt of refractors, forming a hollow cylinder, 6 feet in diameter and 30 inches high; below it are six triangular rings of glass ranged in a cylindrical form, and above a crown of thirteen rings of glass, forming by their union a hollow cage composed of polished glass, 10 feet high and 6 feet in diameter. I know of no work of art more beautiful or creditable to the boldness, ardour, intelligence, and zeal of the artist."

Such is the general arrangement and operation of the apparatus for a large lighthouse showing a fixed light. For a revolving light, such as the Skerryvore and the Cordouan, a different arrangement is adopted, which, as it is only a modification of those above described, and as most persons are familiar with the fine examples of this apparatus exhibited in our own Exhibition of 1851, and in the later French Exposition, it need not be dwelt on now.

There is an arrangement of the lenticular apparatus which, at the period of my former paper, was not in use in our English system, although generally adopted in France and elsewhere. It is for the purpose of showing a fixed light, varied by a flash, preceded and followed by short eclipses (*feu fixe varié par des éclats*). It consists of a supplementary system to the ordinary lenses for a fixed light, which as I have been describing, distributes its light evenly all around the horizon in a belt equal to the height of the apparatus, increased by its slight powers of vertical divergence. Around this apparatus, consist-



View of a first order fixed dioptric light.—F, the focus, or flame; L, the lamp; D, E, G, the central belt of refractors; M, N, diagonal brass frames to panels of central refractors; H, I, six lower catadiptric zones; A, B, C, thirteen upper catadiptric zones; O, O', diagonal legs; K, K, service table.

ing of horizontal cylindrical elements, two or four panels of lenses, composed of vertical cylindrical elements, or at right angles to the main apparatus, are made to revolve. The effect of this additional arrangement is to cause those horizontally divergent beams which fall on the inner surface, to become parallelised, and thus reach the observer in the form of a flash, which is preceded and followed by a short eclipse, due to the angle between the parallelised and divergent beams. This, though a beautiful arrangement, has some drawbacks in the absorption of the light through the double apparatus. The effect, moreover, is open to some objection, which will be touched on presently. This form of lenticular apparatus has been largely used of late in the new lighthouses constructed by the United States for their coasts.

Of the seventeen dioptric apparatuses which were employed in British lighthouses ten years since, nearly all the glass portions were of French construction. Our shores had at that time been furnished with almost a complete system of lighting and beaconage, and the apparatus of the catoptric class was of the most refined and beautiful description, perfectly fulfilling its office as far as its capabilities would allow it.

The conditions of pharology in France were different. Soon after the establishment of the lenticular system, in 1822, by Augustin Fresnel—that is, in 1825—the Light-house Commission decided on the exclusive use of that system of illumination for their coasts and those of their colonies; the distribution of the lights being that recommended in the programme and report of Rear-Admiral de Rossel. The Central Commission at Paris established a workshop and dépôt for the construction of the apparatus, and, in the twenty subsequent years, they supplied not only nearly the whole of the first-order apparatus for their own coasts, but also a large number for the neighbouring governments. During this period, the fiscal regulations embarrassing the glass manufacture precluded English enterprise from dealing with the large masses of metal required for the construction of these lenses. Besides this, the material procur-

able near Paris is so superior to any of a similar kind that is attainable from our own country, that it is another reason why our French neighbours took the precedence of us in this branch of scientific art; and thus a large proportion of the principal light apparatus, on a large scale, necessary for the safety of the mariner, had been erected before the removal of the excise duty on glass.

Without pursuing this part of the subject into its details, it will suffice here to state that the foregoing embraces the general principles of lighthouse apparatus as in use in 1847. The minor features, in their great variety, may be followed in the excellent works of Mr. Alan Stevenson and M. Fresnel.

In instituting a comparison of the efficiency and economy of the two systems,—a question which has been strongly discussed,—many points have to be considered. It has been usual with many to give the superiority, on both heads, to the dioptric system; but there are numerous conditions under which it can be demonstrated that the authorities of our Trinity Board have acted quite wisely in retaining the reflector system, under which so many of our fine lighthouses have been established. A few words on the peculiar properties of each will be sufficient now. The discussions, involving a large mass of calculations, are extant elsewhere.

The effect of a paraboloidal reflector of 21 inches diameter and 4 inches focus, when viewed directly in front of the flame of the lamp, one inch in diameter, is equal to 270 flames; at a divergence of 7 degrees from the axis, about 44 flames; and between 9 and 10 degrees of divergence from the axis it is 2 flames. The diagram above will illustrate this distribution of the light. The available or useful amount of divergence altogether is about 15 or 17 degrees, the actual amount from such a flame is 14 deg. 22 min. Vertically, the divergence is about 16 deg. 8 min., or it will be serviceable to 20 deg. This is a useful property, as will be seen presently. It will, therefore, take from 25 to 33 such reflectors to form a complete circle of useful light. But this cannot be evenly distributed over the whole azimuth. The spaces between the axes of each reflector will be illuminated with a fainter beam. This inequality in the distribution of the light is the great disadvantage of the catoptric principle for a fixed light. For a revolving light, when eight reflectors are placed on each side of a revolving triangular frame, a flash may be attained quite as bright as that from the great annular lens of Fresnel. The duration of this flash is also three times the duration of that from the lens—a great advantage, but then the eclipses between the flashes are total, in which the Fresnel system has the superiority.

The dioptric system owes its great superiority, for a fixed light, to its perfectly fulfilling the very important condition of distributing the light evenly all round the horizon. For a revolving light the eight lenses will give flashes of equal intensity, but of much shorter duration, than the 24 reflectors of the catoptric light. The secondary light from the fixed upper and lower zones compensates for this inferiority. The lamp of the dioptric apparatus consumes the same quantity of oil as 15 of the reflector lamps, and is therefore more economical, in the ratio of 5 to 8, supposing the serviceable effect of these lights to be equal, but this does not quite fairly state the case. Fresnel calculates that in a first order apparatus for a fixed light, the brilliancy of the dioptric drum, or central portion of the apparatus, will be equal to 360 flames, that of the cupola of catadioptric zones above to 140 flames, and the lower zones to 60 flames, a total of 560 burners in all directions. Mr. Stevenson, who is probably nearer the mark, says 450 burners for the joint effect of the dioptric and catadioptric parts of the apparatus for a fixed light, and, calculating the whole effect of this apparatus as compared with the reflector light, that with the same quantity of oil, about four times the quantity of light is produced by the lenses

as by the reflectors; but then the light, as seen before the axis of each reflector, would be 50 per cent. more powerful than the dioptric light. In revolving lights, assuming the same calculations, the dioptric light is more advantageous than the reflector, in the proportion of 3·6 to 1. This is supposing that the light is required round the whole horizon, but in numerous cases only a portion of the circumference is required to be illuminated, and this circumstance still reduces the average superiority of the dioptric system, so that, all things considered, the relative advantage of each system may be from one and a half to twice in favour of the dioptric.

There is one appearance which is produced by the lenticular apparatus which could not be made by reflectors, and when the distinction between one light and another is of such paramount importance, this is no small object, I allude to the fixed light varied by flashes. Perhaps this variety may be overrated in its utility. Mr. Alan Stevenson does not think it of so much value in its distinctive characteristic, and, up to a recent period, our Admiralty included in their list all of this sort of light with the revolving lights. From the brief duration of the flashes, and the long interval between them, usually three or four minutes, they may not be observed, and, in some cases of hazy weather, or snow, or other adverse circumstances, be not made out, and thus the light might be mistaken for an ordinary fixed light. The flashes are sometimes coloured red. In the French light, where colour is employed as a distinction, it is very pale, but in our English lights, those thus shown, which are of such intensity as is considered to be a useful distinction, lose 0·8 of the whole incident rays, which enormous loss forms a great argument against the use of coloured media if it could be avoided. Green or blue shades are still more objectionable from their great absorptive powers.

The lamps which are used in these beautiful instruments are all more or less modifications of the cylindrical wick lamp invented by Argand, in 1783. Those in use for reflectors are the same as they were left by the inventor himself. For the great dioptric lamp, various contrivances have been made for regulating the supply of oil to the compound burner.

For a first-order light, this lamp consisted, in the first instance, of four concentric wicks, of the respective diameters of 0·827, 1·69, 2·52, and 3·39 inches, the smaller apparatus being constructed of 3 or 2 concentric wicks; but within these last 7 years the interior wick has been dispensed with in all the burners, it being found that a light of superior brightness can be obtained by allowing more air to pass into the flame on the inside, and forcing this air outwards on to it by a metal breaker or button kept below the level of the flame, so as not to interfere with the rays of light emanating from all sides of it. This, though it rather increases the consumption of oil, produces a far better light. The oil is made to flow into the burners by various means, as is stated above. Fresnel's invention consisted of a series of four small pumps, worked by clock-work, which forced the oil upwards to the flames. Another mode was by weights acting on a piston; a third by a spring doing the same office, a plan which has since become in universal use in the moderator lamps. Another mode, the pneumatic lamp of Messrs. Wilkins, acted by means of the pressure of air in the reservoir, and another, frequently applied of late, is by placing the reservoir slightly higher than the lamp, the oil thus flowing freely by its own gravity to the required level.

The fuel used in the English lighthouses in these excellent lamps up to the year 1846, was the best sperm oil that could be procured. At that period a change was made throughout the whole of the lamps, by adapting them to the use of colza or refined rape-seed oil, requiring a thicker wick. This oil was in use in the French lighthouses for some time prior to this, and was procured from the seed of a peculiar species of wild cabbage, known in the north of France under the name of

colzat, or colza. This plant is extensively cultivated in Normandy, &c., the chief markets for the oil being Caen, Rouen, Lille, and Courtrai. That now used by the Trinity-house is chiefly refined by a patent process. This refined oil is of a superior character to the sperm oil; it produces a brighter flame, does not cause so much deposition on the wick, consequently, will burn much longer without trimming; any adulteration in it is much more easily detected than in sperm oil, and it is half the cost, although it has increased in value from 3s. 9d. per gallon on its first introduction, to 4s. 10d. at present. It is an excellent substitute for that oil, which is annually becoming dearer, and more open to being mixed with other and inferior oils. In the Liverpool lights olive-oil has been used since 1847—a change effecting a saving of 40 per cent. on the use of sperm-oil. In our colonial lighthouses other varieties of oil are used, of which one only need be noticed as being used in the lighthouses near the Cape of Good Hope. This oil is procured from the tips of the tails of the Cape sheep, and is said to be far superior to any other oil for brilliancy of light, but the quantity consumed, and the expense, are great. It costs 10s. 6d. per gallon, and the first-order light of Cape Agulhas consumes about 730 gallons a-year; 482 gallons of rapeseed-oil would be necessary for a year's supply.

One great advantage in the refined rape-seed oil is that it does not thicken, except upon a very great degree of cold, a qualification which places it far above sperm and many other oils for winter use. Indeed the change is a fortunate one in another respect. The untiring perseverance of the whale-fishers from the neighbourhood of Nantucket has so dispersed and destroyed their prey, that it is almost doubtful if a continuous and sufficient supply could be maintained, except at great prices.

The purity of the fuel, and the perfect combustion effected by the present arrangement of lamps, keep the flames used in the apparatus in their normal condition; but it is necessary to carry off the products of combustion from the confined space of the light-room, for, if they were not disposed of, they would both materially diminish the power of the light, and also be a serious detriment to the health of the attendant light-keeper, whose constant presence in the light-room is strictly required. This is effected by the ventilating tubes devised by Dr. Faraday, with the principles of which most are familiar; they are fitted to all our lighthouses. A plan, similar in action, but less complete in detail, was promulgated at the commencement of the present century by Dr. Van Marum.

As far as they were applied, then, the catoptric and dioptric systems, in use in the year 1847, acted perfectly; but still there was some waste of light, caused in one direction by the divergence of the instruments, and, in another, by their construction. The consideration of this loss of power led to the next steps in the science of pharology; since that period, some new arrangements have been proposed, by which some of the disadvantages of the dioptric system have been partially avoided. M. Letourneau proposed lengthening the duration of the great flash of the dioptric lens, by dividing it into two portions, and setting each half at a slight angle outwards; this would produce the desired effect, but it must be at the expense of brilliancy. Several other minor improvements also have been suggested, but the main features of the system have remained unaltered. There is some waste of light in both the systems. In the catoptric it is that angle comprised between the angle formed by the lips of the reflector and the flame and the horizontal ray which strikes the outer edge of the reflector. That portion of the light which passes upwards is, of course, lost for useful effect—the other portions may be considered asserviceable. In the year 1849 Mr. Thomas Stevenson proposed some arrangements which obviate this loss, upon what is termed the holophotal system.

The ordinary paraboloidal reflector is rendered holo-

photal as follows:—A small portion of the back of the reflector is cut off, behind the parameter, the line which passes through the focus; for this is substituted a portion of a spherical mirror of the same focus. In front of the flame a lens with three diacatoptric rings is added. The action of the spherical reflector is to return all the rays impinged on it back through the flame, and thus on to the posterior sides of the lens and diacatoptric rings. Therefore, all the rays which emerge from the lens, &c., will be horizontal, and the remainder, those impinging on the paraboloid, will also be reflected in the same direction. The Horsburgh Lighthouse, in the strait of Singapore, is fitted with 9 such holophotal reflectors—three on each face of a revolving frame, each side of which, it is said, gives as much light as five reflectors of the ordinary kind. This was completed in 1851. A similar apparatus, a red light of the same sort, was placed at Wick, in Caithness, in 1851.

Fresnel's revolving light system, as at work in the Skerryvore and the Cordouan, with its beautiful but complicated upper system, is rendered holophotal by a very simple means. The zones above and below the main lenses act in the same way as the centre, and, by the whole apparatus revolving, nearly the whole of the light is projected horizontally in the eight directions of the octagonal prism. The diagram and the very beautiful fourth-order apparatus exhibited explains its action. Proceeding upon the assumption that the whole of the emitted rays from the central lamp may be made to assume the horizontal direction, Mr. T. Stevenson has made several most excellent arrangements, which, however, we cannot fully describe here. The simplest form is that of a hemispherical metallic reflector, in the focus of which is placed the lamp; before the lamp is a refracting polyzonal lens, of such a section that the whole of the direct rays from the lamp, and the reflected rays from the posterior reflector, are parallelised on their emergence. Carrying this principle to greater refinement, and as it was found that the totally reflecting glass prisms were effective compared with metallic reflections as 140 to 87, a hemispherical arrangement of glass is proposed, which, by refraction and total reflection, produces the same result as the metallic hemisphere in the former instance. The formulæ for the construction of this ingenious apparatus were calculated by Mr. Wm. Swan, F.R.S.E. The glass refracting mirror has one advantage over a metallic mirror in its powers of radiation, as in an experiment the heat in the interior of the apparatus was so great as to cause the oil to boil: an inconvenience, however, which was afterwards obviated mechanically. Very numerous other applications of his principle are also proposed.

M. Letourneau has proposed a simple arrangement of the fixed light with flashes, of the French system. It consists of alternate panels of horizontal and vertical lenticular elements, which, on revolving, show the alternate flash and fixed light without loss of power from the supplementary revolving lenses, as in Fresnel's arrangement. This may be readily exemplified by the beautiful apparatus before you, for, supposing that each alternate panel of this revolving light were made to consist of horizontal elements instead of circular ones, the effect would be first the flash from the circular face, and then the steady light during the period that the plane side was passing before the eye.

The effect of all these optical refinements is to send forth the light from our lighthouses in a thin disc or ray without vertical divergence; but with great deference it is urged that this may be overdone; for, suppose that the apparatus acts perfectly, and the thin disc of light should only osculate the horizon of its station, it is manifest that any observer in any other position than the exact circle of this horizon, will have to mount some elevation, in order to see the light at all, and that to any one passing within even a short distance of it the light will be invisible. Some amount of vertical diver-

gence is absolutely necessary, and the optical defect of the reflector becomes a real advantage. We may cite the recent melancholy example of the *Dunbar*, wrecked beneath the lighthouse at Sydney, which was intended for her safety, but could not be seen because it was overhead. Red panes of glass have been added to some of our lighthouses at the lower part of their lanterns in order to point out to ships coming into their effect that they are inside danger.

Up to this point, therefore, we may consider that our lighting is perfect; all future optical improvements can only be introduced on the score of economy, and any increase of power must arise from the source of light. All the powers of our lenses and reflectors aided by the most efficient lamps, are futile against the obscuring effects of haze or rain or snow, and to be able to conquer this difficulty in the least degree will be the greatest step in the lighthouse economy.

The dioptric system does not appear to be adapted for floating lights as at present constructed. Mr. Wilkins and Mr. Letourneau have tried an arrangement of four lenses in front of the four lamps, behind which are spherical reflectors, being, in fact, a species of holophotal apparatus. But the great motion of the vessel prevents the possibility of keeping this apparatus constantly in a vertical position, a condition which is absolutely necessary for its proper action. Our light-ships are, therefore, still furnished with 12-inch reflectors, one of which is exhibited. These being mounted on gimbals, readily obey every motion of the ship, and by their great divergence (though consequent loss of light), obviate all those inconveniences which larger instruments would be subject to. But then these lamps and reflectors, up to this time showing a superior light to ordinary lamps, will not bear that comparison with those now used by steam vessels that they did in former years.

The Messrs. Chance, of Birmingham, the well-known glass manufacturers, have successfully competed with our French neighbours in the material as well as in the manufacture of the light-house lenses; and I believe their factories are the only place in this country where the operations are carried on to any extent. The fine and important light on Lundy Island, at the entrance of the Bristol Channel, is an example of their construction. It is a first-order holophotal apparatus, showing a revolving light. They are now engaged in making some important apparatus for our Trinity Board. It was believed that the glass could not be made in England so pure in colour, or rather with absence of colour, as to compare advantageously with that made near Paris, but these difficulties Messrs. Chance have overcome, and although I believe that some French material is employed, yet the improved processes have produced a result which compares well with the French apparatus shown in the French Exposition.

I now come to a very important point in the present subject. In 1832, Lieut. Drummond proposed the use of the now well-known oxy-hydrous light for lighthouse illumination, and an extraordinary instance of its power was given at the time, showing that a Drummond light, 70 miles off, appeared nearer to the observer than an ordinary lighthouse lamp and reflector 12 miles off, an irrefragable proof of its superiority if it could have been managed with certainty; but, notwithstanding the most careful study and the most ingenious contrivances, it has been found impossible to maintain the light with that steadiness which is absolutely necessary for lighthouse purposes.

Ten years since hopes were raised that the electric light would be so far perfected by Messrs. Staignt and Petrie as to supply this most desirable improvement, but the difficulty in maintaining the light in its normal character led to its abandonment.

It has been carried to greater perfection under the arrangement of M. Duboscq, and is in general use in our philosophical experiments, but it requires delicate manage-

ment. The principle is that of passing the electric current between two vertical pencils of carbon. I am much indebted to Professor Goodeve for kindly exhibiting this beautiful light, which, as you see, when applied to the holophotal lens apparatus, has a most powerful effect. Mr. C.W. Harrison has made a different arrangement, which obviates the inconvenience of maintaining the exact distance between the two poles, which is the main difficulty in the vertical lantern, by making the positive pole a cylinder of carbon, which, by revolving under the negative point, presents a constantly fresh point to the action of the current, passing in a spiral direction from one end of the carbon cylinder to the other. Its action is seen in the apparatus before you. I believe that this is the first time it has been exhibited in public, and certainly it has a very promising commencement.

There are two great difficulties in solving the problem of a steady light from electricity. The first is in maintaining an equable force from the producing elements, that is, the battery, which, of course, will gradually decline in power after a short time, and no means have, as yet, been devised for so thoroughly obviating this, as to keep up for so many hours as the light must be shown. The next is at the outlet of this current; in preserving that exact distance between the two points of carbon, through which the arc passes, which maintains the light in its normal condition. These carbon points are usually I believe, formed of graphite, the substance which is found lining the inner surface of old gas retorts. The rapid disintegration of the positive pole, the less diminution of the negative pole, and the irregularity of the consumption of both under the intense action, have baffled the ingenuity of almost all who have attempted to control them.

However, I am happy to say that I hear that the problem is about to be solved, and that ere long, probably, the electric light will be established at our finest lighthouse. This will be the greatest advance that has been made in pharology since the introduction of the existing system, which, in principle, may be said to have been perfect at the outset.

It is to the talent and patient ingenuity of Professor T. H. Holmes that we shall owe this grand improvement, and I much regret that the nature of the apparatus precludes the possibility of exhibiting it to you in this room, but those interested will, I dare say, soon have an opportunity of examining it elsewhere.

Mr. Holmes has adopted another form of originating the current than has hitherto been tried—that of magneto-electricity. The whole apparatus and its results are an admirable exemplification of the correlation of the physical forces—an evidence that one power may be traced throughout a train of operations until it emanates in a totally different form. The apparatus consists, I believe, of a series of very powerful permanent magnets, around the poles of which the helices are made to revolve by means of a steam-engine, and from the extent of the primary arrangement a most powerful magnetic current is produced, which, passing through the carbon pencils, shows that splendid light which entirely eclipses all other modes of illumination. I am not aware of the method by which Mr. Holmes regulates the distance between his electrodes, but the light exhibited last year, before the Trinity-house authorities, maintained a perfectly steady appearance for several hours, and doubtless might have been continued for any period. It is intended, I believe, to show the light from more than one point, so that it may be renovated without eclipsing it altogether, and even this changing of the electrodes is to be effected *instantaneously*.

This branch of our subject is worthy of the special attention of the Society of Arts, and an evening might well be devoted to the consideration of its merits. When once the system of illumination by electricity or any other similar light is practically established, we shall have an immense advantage in the capability of the lighthouse

system for distinguishing one light from another, a desideratum which is even of more importance now than when the lighthouses were first placed on a proper basis—in fact this branch of it has remained nearly stationary from its origin.

The totally distinct character and colour of the electric light, will at once distinguish it at any distance from that derived from any other source. Therefore, supposing that this illumination be adopted as an adjunct to that in present use, the stations in which it is applied will be distinguished from their neighbours without the chance of mistake, the fruitful source of accident from the present lights.

Respecting the power of the magneto-light, I have not met with any recorded photometric experiments applicable as a comparison; such comparison with the oil-lamps, however, could not be very well made. I have cited the experiment made by Lieut. Drummond; the electric light is more powerful than his light, and I am informed that its penetrative power through a hazy atmosphere is, as compared with the light apparatus in use, 75 to 1; so immense an advantage in the first principles of the utility for lighthouses cannot be overrated. The only comparison which can be made, as it occurs to me, is that afforded by the heliostat, the instrument for solar reflection used in extensive trigonometrical surveys. This reflection pierces the atmosphere to a vastly greater distance than the object from which it is shown, and might be taken as a measurement of the effect of this light.

In its use and in thus economising the power there must be some modification of the optical arrangements now in use. The light, not one quarter of an inch in diameter, would be entirely shut out by the frames of the lenses, or the bars of the light-room. It is probable that some refined arrangement of the Bordier-Marcet apparatus will be found to be the best, a specimen of which is exhibited. The action of the reflector I formerly explained. It was largely used in France, but, as far as I know, is only applied to one station in our own country, Ardvishaig, in the west of Scotland.

If a dioptric apparatus be chosen to economise this minute light, it must be of a very refined description, as any defect in it will be developed in its action on account of the smallness of the source of light, and any dioptric fringes, of course, will deteriorate its value, as the red or green rays, at a distance, might cause it to be mistaken for a red or green light. With more than one light, the chances of this will be avoided.

There would be no necessity for a light room for this light; a simple cylinder of glass, of sufficient diameter, would be the best form of protection, and a revolving wiper would keep the glass clear either within or without.

There is one proposition for distinguishing one light from another, which would be readily carried out if it were considered to be desirable, in electric illumination. It is that of the numerical distinction of Mr. Babbage. He proposes that each light should be masked at certain intervals, in such a manner that the light should tell its own number. Thus, being suddenly eclipsed three times at short intervals, then a pause, then twice suddenly eclipsed for a short period, would indicate No. 32, &c., the numbers to be arranged in a certain order. The simple breaking contact in the magnetic current will produce the eclipsing effect with the greatest facility and certainty.

Lieut. Raper, in his admirable work, proposes another method of showing a light for sea purposes, that is, by illuminating the clouds and haze over the station by the electric light. This shaft of luminosity might be inclined in various directions, or it might be made to revolve by proper optical arrangements, and this would give a great relief to the already exhausted resources for varying the appearances of lights; but there is one case which might render this system of no avail, and that is a perfectly pure atmosphere.

I wish now to draw special attention to another topic,

which I think has a most important bearing on our present subject. It is the question of the lights carried by steam vessels, which I shall be able to show is daily causing more and more confusion in the capabilities of the lighthouse system, and by diminishing its efficiency is introducing a fresh element into its requirements.

On December 15th, 1847, the day on which my former paper was read, an order was issued by the Board of Admiralty, arising out of a careful series of trials and evidence, that all H.M. steam-vessels should be fitted with a bright light at the mast-head at all times, and when under steam to show, in addition to this mast-head bright light, a green light from the starboard-bow, and a red light on the port-bow. This system had been adopted previously by our principal steam-packet companies. On January 1st, 1852, an Act of Parliament came into operation which rendered it imperative on all steam-vessels to adopt the above system, which was also carried out by the governments of the principal foreign maritime nations. The object of the red and green lights, which are so screened as not to be visible except on their own sides, is to show to passing vessels the direction in which the steamer carrying them is going. In the Thames, above Yantlet creek, a more simple lighting of steamers is adopted, consisting of a foremast-head light, and a bright light at the bowsprit end or in the bows. These arrangements, if properly carried out, answer all the purposes required of them.

But the requirement has led to such improvements in the manufacture of these steamers' lights, that they rival in excellence and brilliancy the lighthouses and light-vessels that are established for their guidance, as may be readily comprehended by comparing the examples of these masthead lights which I am enabled to exhibit, with the reflectors of our light vessels. No judgment can be formed of the distance of a light, unless its absolute brilliancy be known, and there be no obscuration.

These excellent lamps may be, and constantly are, mistaken for the guiding lights on the shore, and many fatal examples might be cited of such an error. One very recent will suffice:—The *Loeander*, an American barque, proceeding down the St. George's Channel on the night of February 11th, 1858, saw a light, which was taken for that of the Tuskar Rock. It was afterwards discovered, when too late, that it was that of the screw-steamer *North America*. A fearful collision then took place, and the unfortunate ship and nearly all her crew were sent to the bottom in a few minutes.

In Mr. Wilkin's lamp the dioptric belt in the middle is precisely a portion of Fresnel's fixed light apparatus, and is of equal beauty with that refined system. Its action, after what has preceded, will be very readily comprehended. It is exactly a resemblance of a large lighthouse or a harbour light.

The question of steamers' lights is again under discussion, and a bill will be brought before Parliament forthwith for its further regulation, but the source of confusion I point to cannot be obviated, and it demands some consideration, in a primary sense, whether the whole system does not require revision. In the case of the Nore light-ship, the oldest of its kind, it was found necessary to change its fixed light to a revolving light; it could not otherwise be distinguished from the very numerous steamers so frequently at anchor near her, or passing in or out of the Thames. In some cases a red light has been added to the floating light, but this is ambiguous, as the steamer under way will carry the same appearance.

I have but little to add to my former paper, on the subject of the structures for exhibiting light. When Smeaton constructed the Eddystone, he established a principle on which all similar structures in our country, the Bell Rock, the Tuskar, the Black Rock, the Skerryvore, have been erected. The pile lighthouse in an exposed situation, as attempted at the Bishop Rock, the western-most of the

Scilly Isles, and on Minot's Ledge, Boston Bay, Massachusetts, have not been found to answer. Mr. Alexander Gordon, however, among the numerous colonial lights he has erected, and is still superintending, has introduced some new features. The fine iron tower on Bermuda has been copied for several other stations, one of which, for the Bahamas, till recently reared its head near the Regent's Canal. In a lighthouse now being built on the Roman Rock, Simon's Bay, Cape of Good Hope, he has made the flanges of the iron plates of the lower part of the tower external, and the spaces between these flanges are filled with Trinidad pitch, which affords a perfect protection from the action of the sea on the iron. He has proposed a tower with a leaden base for the dreaded Skerki Rocks, in the Mediterranean. In the important lighthouse of the Basses, on the south coast of Ceylon, an iron tower is constructed, around the base of which a granite casing, fitted together in this country, is being built, affording a martello-tower like protection from the tremendous sea, and a habitation for the keepers. A lighthouse with perpendicular sides perhaps would obviate some of the drawbacks to Smeaton's system. The sloping base of these towers leads up the waves, and in the case of the Eddystone, in 1838, the coping was much injured by an enormous wave, which mounted up the side of the tower. We might find numerous examples in nature of such a column withstanding the tremendous shock of the ocean-waves, one of which, the St. Peter or Black Rock, to the south-east of Japan, shown on the chart exhibited, affords a good example. The admirable wooden structure on the Eddystone, erected by Mr. Rudyard, in 1706, may also be cited. This might have existed to this day, but for its unfortunate destruction by fire in 1755. Mr. Gordon, in using wood as a material for lighthouses or their adjuncts, proposes to use Mr. Maugham's patent for its preservation. This consists in boiling the wood, for a few minutes, in a saturated solution of phosphate of ammonia, under a pressure of 20 lbs. to the square inch. The rationale of this process is, that every pore of the wood becomes saturated with oxygen, and therefore no chemical action of seawater will tend to its decay.

I have thus described, briefly and imperfectly, the main features of our lighthouses—their progress towards perfection, and their present condition. All that I have alluded to is in present operation, with the exception of the electric light, and that may be said to be accomplished. I have shown that every refinement and economy in the illumination has been attained, and that more cannot be expected in that direction than we at present possess. All these matters refer to the progress and improvement of its details—I have had no new principle to describe to you, with the exception of that great step, the magnetic illumination; in other respects it remains the same as when William Hutchinson constructed his reflectors, or Rogers erected his lenses in the Portland or North Foreland lighthouse. In the meanwhile, another system, antagonistic to its efficiency, is daily growing into permanent importance. The wonderful advance of steam and auxiliary steam, as applied to our ships, develops a new phase in navigation, and our crowded channels are now traversed by this class of vessels, whose voyages are made and completed with the speed and certainty of our railway-trains. The pressure of modern times will not allow the commander of a steam-vessel to exercise that slow caution which was the safeguard of the mariner in former years. It was thought that, when all the dangerous points of our coasts were indicated by lights, that this "hand-rail" up the Channel would be a perfect help and security at all times. Now, however, each steam-vessel carries those false lights which, like those of the wreckers of former times, may only lure to destruction.

These considerations naturally lead us to revert to first principles—to enquire whether our lighthouses, as a system, are as near perfection as is required—

if not, in what direction are we to look for future improvement?

The English and St. George's Channels are the greatest maritime highways of the globe, their dangers and difficulties are but a type of all others, but they are better known, and moreover they are, as has been observed, as "well-lighted as Regent-street." Yet an inspection of the two charts before you will tell a tale more impressive than any words I can say. The one exhibits the localities on which total wrecks only took place in the English and St. George's Channels, during the years 1852, 1853, 1854, 1855, and 1856. The other, of similar character, shows the localities where collisions (the growing evil) have occurred during the same period. A cursory glance at these charts conveys the same sort of information as does the enumeration of the killed and wounded in some great battle, yet each figure in the one, and every black dot on the other reveals an amount of personal misery, of suffering, and the entailment of such an accumulation of sorrow and privation to thousands, that each one of them might easily form the text of a thrilling tale.

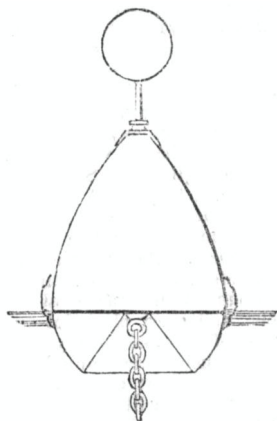
On a little closer examination a singular fact presents itself; it is, that the great majority of wrecks and collisions occur in the immediate vicinity of the lighthouses intended to guard against the dangers around them. There can be no doubt of this very important fact; and it may be readily accounted for by the universal practice of all ships, as far as possible, sailing along the coasts within sight of the lights, taking a fresh course at each point, when the general trend of the coast changes its direction. The numerous chances of error in a ship's reckoning then place it in constant peril from the proximity of the dangers it is desired to avoid. I have previously shown that our fixed structures have been pushed as far forward into the sea as human means could build them.

Many calamities have demonstrated that a mid-channel course, without very great caution, is a hazardous proceeding, especially to inward-bound ships. The reasons for this are, the varying direction and rate of the tides, which, however, are now better known and guarded against, and the local attraction of the ship herself upon her compasses. This latter unheeded source of danger has led to many losses; the mid-channel course is at right angles to the magnetic meridian, and, therefore, this element of erroneous reckoning is at its maximum. Its tendency in an up-channel course is to draw the ship's head to the southward, and hence the very numerous and distressing wrecks on the French coast, south of Boulogne, of which those of the *Reliance* and *Conqueror* may be cited as well-known examples. These disasters would have been averted had any fixed mark certified the commanders of their exact position and courses.

It is then, I believe, to floating structures we must look for future improvements in pharology. Our light vessels, as at present constructed, and as I have shown, are quite incompetent to fill any important station in the system.

The desideratum is supplied in the principle proposed by Mr. George Herbert, which I will briefly describe to you without going into those questions of wave-power and other collateral topics which may be well discussed elsewhere, or in alluding to the fallacies in principle which are at present applied to our floating beacons. The conditions required for a floating beacon are that it should keep upright to be most efficient, and for a floating light that it should, in addition to this, be free from any violent oscillation, such as is experienced by ordinary vessels. Mr. Herbert effects this by mooring his beacons which are of circular plan, from their centre of gravity, which is so arranged as to be nearly or quite on the line or plane of floatation. Beginning with the simplest form, that of a spiral buoy, as in the figure, the bottom of the body is hollowed out and raised up, and the mooring attached to the upper part of the cone.

Such buoys were brought into use by the Trinity Board, in 1854, and perfectly fulfilled the condition proposed.\*



Proceeding higher in the scale of importance, Mr. Herbert proposes a refuge-beacon on the same construction, which may be moored in those places where a conspicuous seamark is imperatively necessary, and where the dangers around it call for some such aid for the shipwrecked mariner. A beacon of another construction, which proved serviceable in this way on the Goodwin Sands, was designed by Captain Bullock, and another by Mr. Walker. Mr. Herbert's plan is much more advantageous, as it would be placed outside the danger, and only a portion of the risk which would be incurred if it were on the danger would be encountered in reaching it. It consists of a circular base 20 feet in diameter, rising 2 feet 6 inches above the level of the water, on which a column rises to the height of 26 feet, the beacon itself drawing 5 feet of water. Around the deck or platform are stanchions, for the protection of those so unfortunate as to be obliged to resort to it. It is moored from its centre of gravity on the floating line, and must, if brought into general use, be of the greatest service in distant and exposed situations. Such a beacon was moored experimentally in 1854, on the overfall of the South-sand Head of the Goodwin Sands, in a position in which no vessel could have lived. It afterwards sunk. It was carefully watched by the master of the neighbouring light-ship, who states that the tide did not appear to have much effect on it; that the wind could not affect it to cause it to roll; that its motion was greatest in a short breaking sea; and that when he was on it he could not perceive any tugging on its mooring. The sea might have washed over its deck (2 feet 6 inches above the water), but never broke against the tower, a most important fact. It may have rolled about 5 feet out of the perpendicular, that is about 10 deg.; at the same time the light-vessel herself was washing about from side to side, her mast vibrating more than 26 deg. This vibration at times, and at some stations, is found to exceed 40 deg. from the perpendicular.

But the most important application of this excellent principle, will be in the establishment of floating light-houses. If the stability and security of mooring a buoy of this construction be established, there can be no difficulty in extending the principle to any magnitude within the capability of engineering skill, which, as is familiar in this room, is employed now to overcome difficulties far greater than that of securely mooring a body of the dimensions required for our purpose.

\* In the River Hooghly, where the stream runs seven knots an hour, these buoys maintained a perfectly upright position, and they are being used to buoy the rapid rivers of Burmah and Siam. All buoys previously used in the Hooghly were carried under water by the force of the stream, their whereabouts being indicated only by a struggling on the surface of the water.

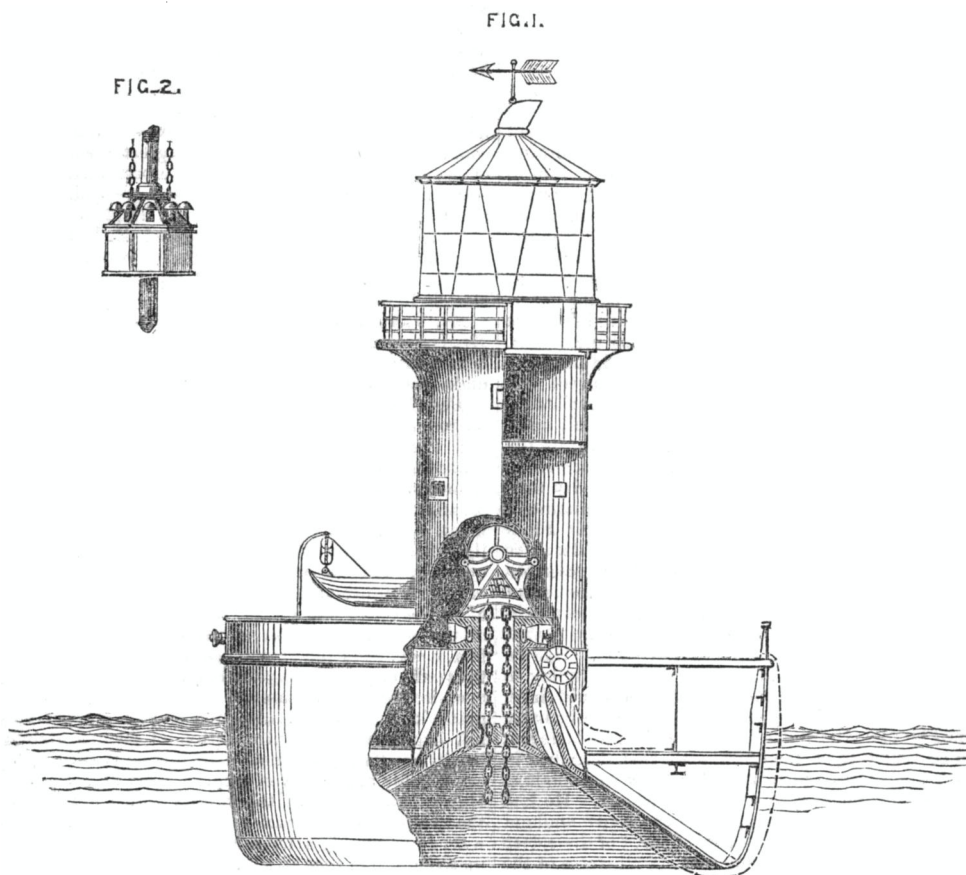
The outline of Mr. Herbert's proposed floating lighthouse as shown in the woodcut, is intended to show a light at an elevation of 40 feet, giving a range of 11 miles, or it may be raised to any elevation, say 80 feet, having a proportionately large base, which with the height of the spectator will give a horizon of 27 miles in diameter. The diameter of the base is 45 feet, and the draught of water 11 feet. The displacement is equal to 325 tons. It will be constructed wholly of iron, with all those contrivances now so well understood for ensuring very great strength, durability, and power of resistance. The one great essential that it shall maintain its position, is most carefully provided for. Four chain cables of the largest size and strength will be used, and by laying these in the different directions which experience will show to be those from which the severest strain will come, they will have but little strain in excess of their weight, and whatever that may be, it will only be necessary to compensate for it by diminishing the ballast in the floating base. The action of the waves upon the structure, when moored beyond the reach of the broken water, when the regular swell, however great, passes it, will only be to lift it vertically at regular intervals through a distance proportioned to, but not equal to, their height; thus the strain arising from this source can be readily calculated. It is proposed to use chains three inches in diameter, which it is believed will withstand a strain very many times greater than any to which they can be subjected. These chains pass over a windlass, which, with the central tube or hawse pipe, turns freely as a swivel on the middle of the body, so that the beacon may turn without twisting or fouling its chain. I need not dilate on the many ingenious methods devised for meeting any exigencies; suffice it to say, that all its parts have been successfully studied, and I have no doubt of the ultimate success of the proposition.

The tower will be of sufficient dimensions to carry the finest dioptric or catoptric light, and in all respects it can be established as efficiently as a structure on shore. A comparison of its dimensions can be made with those of the lantern of our present light vessels. This is given above on the same scale. The annual cost of maintenance not exceeding that of shore lighthouses.

With such an addition to our present system of lighting, how many difficulties will disappear, and how many advantages may be immediately placed for the furtherance of the progress and certainly of navigation. I will cite an instance: Lieut. Fraser, of the Bengal Engineers, has recently visited England to obtain information as to the best mode of proceeding to erect a lighthouse on the Alguada Reef, at the eastern promontory of the Bay of Bengal. This reef is about 12 miles from the shore, and just awash. It is very much in the way of passing vessels. To build a stone or iron lighthouse would be very expensive, but to place a floating lighthouse which would be equally efficient, would be a simple matter. It could be built here and put together in that country, and towed to its destination. Further, its keepers may be regularly relieved by the passing packet to or from Calcutta or Rangoon. If the lighthouse be on the reef there must be an establishment on the shore, here barren, inhospitable, and unhealthy, and should the weather be unfavourable, landing at the lighthouse would be impossible; in fact, it will be a second Eddystone or Bell Rock, with all their inaccessibility, and this moreover in the very unfavourable position of the Bay of Bengal.\*

Although I have no more interest in this than what is induced by a favourite subject, I most earnestly trust

\* There are many situations round the coast where the Floating Beacon would prove of greater service than the light on shore, as its position could in most cases be chosen according to the necessities of the case, irrespective of many considerations which must now often rule the selection of the site, and of necessity deprive the light of that full benefit it otherwise would afford.—*Naut. Mag.*, December, 1857, p. 677.—Capt. Bedford.



soon to see this principle of Mr. Herbert's practically added to our resources for navigation. There may be some hope of this, as I see in a parliamentary paper just issued, that the government authorities think it expedient and desirable that its practicability and efficiency be tested. I feel quite confident as to the result.

Now, as to its application to our lighthouse system. Mr. Herbert proposes to moor a series of these lighthouses in a direct line up the English Channel, and a similar line up the St. George's Channel. The outer light of the former channel will be 40 miles south-west of Scilly, on the parallel recommended for vessels to make for the Channel, but from which when now made, they are compelled to run within the reach of danger, in order to verify their position by sighting the lighthouses. From this point a line of these fabrics should be moored at each degree of longitude up to Dungeness, or eight lighthouses in all for the English Channel. Although their horizons will not, as proposed, overlap each other, that is, one will be lost sight of before the other is seen, yet they will be sufficiently near to each other for steam-vessels to steer their course by them with the utmost confidence. The same system applies to the St. George's Channel, as will be readily understood by the diagrams exhibited.

The outermost of the floating lighthouses would communicate by electric telegraph with the shore, and thus any want or announcement would be made instantaneously in the proper quarters, without the long delays now very frequent. Many other advantages might be placed within the reach of windbound vessels by such an establishment.

It is proposed that these lights should be of one exclusive character, differing from the shore lights. Either let them all be fixed, and alter those now fixed to varying lights, but I think it would be preferable, and I now suggest it, that the electric light, with its marked distinction, would be admirably adapted to develop the utility of such a system.

Such a line of lights once established, their utility is made manifest in a very few words. Let it be imperative, that all our steam vessels in going westward pass to the northward of those lights, and those steaming eastward, or up the Channel to the southward of them, leaving them in each case on the port hand.

These fairway lights would prove an invaluable acquisition to the mariner and the shipping interest at this period, by relieving the commander from that intense anxiety to avoid collision and danger, the chances of which now inevitably accompany his progress up these crowded channels; and we might then hope to see, in a future record of collision and wreck, a far smaller list of calamities than we now see crowded around our lighthouses.

These noble structures in all their utility would still be the safeguard of the coasting-trade, and of all ships not driven by the pressure of the times to sacrifice safety to speed.

With these remarks I close. I have endeavoured concisely to describe the past and present condition of our lighthouses, and to indicate what I believe will be the future direction for their improvement. As the talent and ingenuity of many have raised this beautiful system of applied science to its present high position, so it is

open to my auditors to endeavour to supply what may be now required as fresh necessities arise.

#### DISCUSSION.

Mr. GEORGE HERBERT expressed his gratification at the notice which had been taken of his humble efforts in connection with the subject of lighthouses, which had been described in so lucid a manner as to leave nothing further to be explained. It only remained for him to express his thanks to Mr. Findlay for having brought this important subject so prominently before the meeting.

Mr. MATTHEWS also expressed his obligations to Mr. Findlay for the able manner in which he had treated this subject. With reference to Mr. Herbert's system of floating lighthouses, he thought there could not be two opinions, for there was no doubt that the right place for lighthouses was the channel that ships must take, and until that plan was adopted they would not have the system in perfection. He begged to correct two slight errors into which Mr. Findlay had unintentionally fallen. The first was with reference to sperm oil being more easily adulterated than colza oil. It was quite the reverse. Sperm oil was the most difficult to adulterate, on account of its being of much less specific gravity than any other burning oil with which they were acquainted. The second point he would notice was, that Mr. Findlay had attributed the invention of the deep reflector to Mr. Thomas Stevenson. The entire apparatus described in the paper was patented and employed, and the patent had expired some years before Mr. Alan Stevenson published his work, giving an account of the invention that had been attributed to Mr. Thomas Stevenson. Had he been aware that it was the intention of Mr. Findlay to touch on this portion of the subject, he would have brought with him one of the deep reflectors originally designed by Mr. Alexander Gordon, which, he believed, would be found to be identical with that described in the paper, and from which a greater light was obtained than from the reflector of Captain Huddart. He had the testimony of Mr. Brookin, one of the Newfoundland Lights Commissioners, that a face of three of these deep reflectors was capable of being seen, in all states of the atmosphere, at a distance of over 80 miles, and he knew of no other description of reflector of which, with the same number of faces, the same results could be recorded.

Mr. WILLIAM HAWES remarked, that the very able paper to which they had listened, gave rise to ideas interesting to this Society. It had been shown that up to a recent period the glass reflectors of France were of a superior description to those of this country, but since the duty on glass had been abolished, so rapid had been the improvement in that branch of manufacture, that Messrs. Chance now made reflectors equal, if not superior, to anything that had been produced on the continent. This was one practical illustration of the effect of Excise regulations upon the manufactures of this country, and one which ought not to be passed over unnoticed by the Society of Arts. The next point to which he would allude was, that by the new system of lighthouses proposed, the warnings were to be placed, not in places of danger, but in situations of safety. The map before them exhibited the extraordinary anomaly that where lighthouses most abounded, the greatest number of casualties had occurred, and it would really seem that lighthouses, under the present system, attracted ships into the very danger that they sought to avoid, and that in the search for the lights the vessels approached nearer to the point of danger than would be the case if those warnings had not to be sought after, particularly in bad weather, when the risks of navigation were immeasurably increased. He, therefore, attached the greatest importance to the proposition to establish lighthouses in positions of the *greatest safety* instead of in those of the *greatest danger*, the search for which led to the misfortune they were intended to provide against.

The final success of a system, the desirability of which he thought everyone would admit, was, therefore, dependent upon the construction of such vessels as could be moored in mid-channel, in deep water, so securely as to be almost beyond the possibility of accident arising from the effects of the most violent storms. If that could be effected,—and our naval architects and engineering skill had surmounted far greater difficulties,—he thought there could not be two opinions as to the great practical value of the system propounded by Mr. Herbert, which, he considered, ought to be adopted in those great highways of navigation, the St. George's and the English Channels.

Professor GOODEVE then exhibited M. Duboscq's arrangement of the electric light, and gave a description of the apparatus. Mr. Harrison's lamp for producing the electric light was also shown.

Mr. VARLEY desired to add his testimony to that of Mr. Hawes as to the great importance of placing lighthouses in situations of safety, instead of their serving, as under the present system, to attract into danger.

The CHAIRMAN said it was now his pleasing duty to propose a vote of thanks to Mr. Findlay for his excellent and highly interesting paper, including also in that acknowledgment Professor Goodeve and the other gentlemen who had exhibited the various electrical apparatus which had afforded them so much entertainment. Mr. Harrison's plan of producing the electric light had been for the first time publicly exhibited that evening. He was sure they must all feel that the idea of having lighthouses in the centre of the channel instead of on the coast, was a most valuable one, and deserving of the serious attention of the authorities. It was, in fact, recognising the plan adopted for the safe conduct of the traffic of the highways on land, that the traffic going in one direction should pass on the right hand, whilst that going in the contrary direction should proceed on the left hand; and the introduction of such a system in maritime affairs could not but be productive of the greatest benefits in the way of security from casualties. Mr. Hawes had glanced at the results which followed from the abolition of the excise duties upon glass, to which were to be mainly attributed the recent advances in the manufacture of that article. He hoped the relaxation of excise duties would be carried still further, particularly with reference to the duties on paper. It seemed to him a strange anomaly, that, whilst they were voting hundreds of thousands of pounds for the advancement of education in this country, they still maintained the excise duty upon paper, which virtually defeated the objects of the educational votes. He begged to propose a cordial vote of thanks to Mr. Findlay, as well as to those gentlemen who had so ably assisted in illustrating the subject.

The vote of thanks was then passed.

Mr. FINDLAY expressed his sincere gratification that his treatment of a subject, which he had taken up merely as an amateur, had met with the approbation of the meeting. In the notice which he had given of the plans of Mr. Herbert, he thought no greater prominence had been given to them than they were entitled to. The only question was whether such a structure could be moored so as to withstand all the casualties to which it would be subjected at sea, and upon that point he thought there was very little room for doubt. The imperfections of the present lighthouse system must be apparent to all. At present the lighthouse between the Scilly Islands and the Land's-End, gave no better light than that which was ordinarily carried by first-class steam-vessels, and the chances of casualties were thereby very much increased, as one light might be mistaken for another. He thought the magneto-electric light, which he had referred to, would be well adapted for the new system of lighthouses along the channels, and if that were adopted it could never happen that a ship's light could be mistaken for that of a lighthouse. What was required in the traffic of the channels was, a system

like that which had been so successfully adopted on London-bridge—that the slow traffic should pass by the sides each way, whilst the quick traffic took the middle line. By the adoption of such a system, the casualties incident to intermingled traffic were entirely avoided.

The paper was illustrated by numerous specimens of lighthouse apparatus and ships' lamps, exhibited by Mr. W. C. Wilkins, Messrs. Olivers, and Dr. Browne. Dubosq's apparatus for the electric light was kindly lent and shewn by Professor Goodeve, of King's College. In this arrangement the distance between the electrodes is regulated by clockwork, controlled by a detent in connection with an electro-magnet, acted upon by the battery current. Mr. C. W. Harrison also exhibited his arrangement for producing a continuous electric light. This is effected by constructing one electrode of a cylinder revolving, and, at the same time, having a motion parallel to its axis. The other electrode is fixed, and is thus brought successively opposite a fresh portion of the cylinder.

The Secretary announced that on Wednesday Evening next, March 10, a paper, by Mr. Henry Ashworth, "On Cotton: its Cultivation, Manufacture, and Uses," would be read.

#### SOULAGES COLLECTION.

The following is the petition which is about to be presented to Parliament, by the Royal Institute of British Architects, in favour of the purchase of this collection by the nation:—

*To the Honourable the House of Commons in Parliament assembled.*

This the humble prayer and petition of the President and Council of the Royal Institute of British Architects (incorporated 7th William IV.)—

Sheweth,—That whereas a certain Collection of Works of Art and Vertu, commonly known as the Soulages Collection, has been brought to this country at the sole charge and risk of certain patriotic individuals, moved to prevent its dispersion, and to enable it to be secured for our national museums, at a moderate price, which would leave no profit to those individuals, who altogether repudiate the desire for any gain, provided that the collection be acquired and kept together for purposes of public instruction in this country.

That, whereas the Council of the aforesaid Institute of British Architects, immediately on the arrival of the said collection in this country, appointed a committee of members of the said Institute, eminently qualified to estimate the artistic value of the objects forming the said collection, to examine and to report upon the same.

That, whereas the said committee, after diligent investigation and examination, made an unanimous report, most earnestly recommending the expediency of a purchase of the said collection for national purposes, and setting forth the great benefits that would, in their opinion, accrue to the art and industry of this country from such purchase.

That, whereas the Council of the said Royal Institute of British Architects did receive and unanimously adopt the said report, which they caused to be read at an ordinary general meeting of the said Institute, held on the ninth day of February, in the year of our Lord one thousand eight hundred and fifty-seven, when it was received, unanimously adopted, and copies of it directed to

be forwarded to the principal members of Her Majesty's Government.

That, whereas the aforesaid Council and Committee of the aforesaid Institute, moved by their great anxiety that the said collection should not be dispersed, when the valuable and beautiful objects of which it consisted would be lost for purposes of general study and national improvement, but that it should be acquired by Government, in order to be exhibited gratuitously to the public, and to afford at all times a treasury of instruction to artists and workmen, did, on the sixteenth day of December, in the year of our Lord one thousand eight hundred and fifty-seven, attend as a deputation upon the Right Honourable the Lord President of the Committee of Privy Council on Education, to urge upon him most strenuously the important interests they conceived to be affected by the question of the said purchase.

And whereas your petitioners concientiously believe that benefits, greatly outweighing any consideration of the sum of money to be expended in the purchase of the said collection, would speedily result to the development of the great commercial interests connected with the progress of art-industry in this country, in the event of the said purchase being effected.

This petition now, therefore, humbly prayeth, that your Honourable House will be pleased to take these matters into your gracious consideration, and devise such steps and proceedings as may cause the said collection to be purchased and freely exhibited for the benefit of the community at large, and of those more immediately connected with arts and manufactures in particular.

And your petitioners, as in duty bound, will ever pray.

(Signed)

DE GREY, President.  
C. C. NELSON, } Hon.  
M. DIGBY WYATT, } Secs.

16, Lower Grosvenor-street, London.

#### SOUTH KENSINGTON MUSEUM.

During the week ending 27th Feb., 1858, the visitors have been as follows:—On Monday, Tuesday, and Saturday, free days, 3,519; on Monday and Tuesday, free evenings, 3,912. On the three Students' days (admission to the public 6d.), 975; one Students' evening, Wednesday, 344. Total 8,750.

#### Home Correspondence.

##### THE SEWAGE OF LONDON.

SIR,—Mr. Allnutt having mentioned my name, in his paper on "The Sewage of London," in a recent number of the *Journal*, I hope you will allow me space for a few remarks on this important subject. The sewage problem embraces two questions, quite distinct, yet closely connected—1. How is the nuisance arising from the decomposition of organic matter to be got rid of? and 2. How is the waste of fertilising matter, from the escape of sewage into rivers and the sea, to be prevented? Both questions are, I believe, satisfactorily answered in the plan which I submitted to the government referees on Metropolitan Drainage, and which was printed by them in the appendix to their report. In this plan it is proposed to effect the complete and immediate removal of the excrements of the population, by means of the smallest sufficient quantity of water, through a system of earthenware pipes, laid down for the purpose, to force this concentrated sewage through pipes into the country, and to distribute it there in the way recommended by Mr. Chadwick.

The nuisance arising from sewage is occasioned by the decomposition of excrementitious matter, and this again is in great measure owing to the retention of the more

solid part of the sewage in ill-constructed house drains and sewers. By removing all excrementitious matter immediately and completely, and placing it in contact with the soil before decomposition takes place, all the evils that arise from the decomposition of organic matter, under, or in the neighbourhood of, human habitations, are avoided.

Again, by reducing the water in which the excrements are suspended, to the smallest quantity by which their complete removal can be effected, we get rid of the great obstacle to the utilisation of sewage, its great bulk and low value. If we take the daily supply of water to the inhabitants of London at 25 gallons per head, and leave the rainfall out of view altogether, the average annual amount of sewage per head will be 40 tons, and as these 40 tons of sewage contain a quantity of fertilising matter worth 6s., the value per ton is only 1½d. But it costs 2d. per ton to distribute sewage according to Mr. Chadwick's plan, consequently the utilisation of sewage of this degree of strength, or weakness rather, is impossible, and, if we dilute the sewage still further, by the addition of 40 tons of rain-water, it becomes doubly impossible. Suppose, now, that by using one gallon of water per head per diem, we can sweep the excrements of the population through the earthenware pipes we have laid down, the annual amount of this concentrated sewage would not much exceed two tons per head, and its value would rise to 3s. per ton, from which the expense of distribution, supposing it to amount even to 6d. per ton, would form a trifling deduction.

The referees, in their report, state some objections to "the proposed construction of a system of drains for house sewage, and another system for rainfall," which, as they may be brought against this plan, deserve to be noticed here. The first objection is that the water which flows from the streets of London contains foul organic matter to a serious extent, that there is no such difference between metropolitan surface drainage and house-sewage, as to justify the one being removed from the river, while the other is still permitted to flow into it. Also, that the rain falling on the roofs and yards of buildings, is subject to a vast amount of contamination, that much objectionable matter is washed out of the yards of manufactories, and from the various stables, mews, cowhouses, and other places during rain; that quantities of slops are discharged into the house gutters, and that the water-closets are in many houses connected with the rain-water pipes. Now, if we examine Professor Way's analyses of street-drainage water, we find that the quantity of soluble organic matter contained in it is so small as not to be stated separately. It appears also, from his examination of water collected from the roofs of houses, that water thus collected in London is of half the impurity and half the hardness of Thames water, and that the small quantity of soluble matter which it contains, consists principally and almost wholly of sulphate of lime. (Appendix iii. to report of General Board of Health, on Supply of Water to the Metropolis, p. 142.) We may therefore safely assume with Mr. Lawes (*Journal*, vol. iii, p. 264) "that the great bulk of the excrements of horses, cows, &c., in the metropolis, will not find its way into the sewers; that the refuse of manufactures, valuable as manure, which will do so will be comparatively limited, and that the matters abraded from the streets, with their small admixture of the excrements of horses and other animals, will also be of comparatively little value" or importance. The second objection, founded on the difficulty of introducing a fresh system of drains from the large number of gas and water pipes under the streets, and the numerous cellars, vaults, and works of similar construction, has been met by Mr. Allnutt. The third objection is the expense and difficulty of constructing separate drains, and ensuring a separation. If this plan succeeds only to the extent of the receipts covering the expenditure, this objection falls to the ground. Difficulties will have to be met and over-

come whatever plan is adopted, but the difficulties attending this plan, are at least not more formidable than those attending any other.

We now proceed to state some objections to the plan proposed by the referees.

1. This plan does not meet the requirements of the Act, by which it is provided that the Metropolitan Board of Works "shall make such sewers and works as they may think necessary for preventing all or any part of the sewage within the metropolis from flowing or passing into the river Thames, in or near the metropolis." "And the said Board shall cause the sewers vested in them to be constructed, covered, and kept, so as not to be a nuisance or injurious to health." The Act recognizes two sources of nuisance and injury to health,—the pollution of the Thames, and the deposit of decomposing organic matter in the sewers. This plan deals only with the former. The act requires works to be constructed for preventing any part of the sewage of London from passing into the Thames. The referees are of opinion that a sufficient provision will have been made for rainfall in the urban districts, if the sewers of those districts are made capable of removing two-fifths of an inch of rain during the eight hours of maximum flow. They are of opinion that an amount of dilution equal to six times the maximum flow of the sewage, is the lowest point at which it is advisable to admit storm waters into the river. Unfortunately, it happens that when a fall of rain causes a flow of mingled rain water and sewage, equal to six times the maximum flow of sewage in dry weather, the resulting mixture instead of being diluted and, consequently, weaker than ordinary sewage, is much stronger. It was found in one case to contain more than double, in fact, nearly three times the amount of impurity contained in specimens of ordinary sewage. Suppose after a month's dry weather a thunderstorm takes place, and an inch of rain falls in an hour, as sometimes happens, the channels provided by the referees are incapable of removing one-fifth of the water that runs into the sewers; the remaining four-fifths are discharged into the Thames, carrying in suspension an amount of decomposing organic matter exceeding that contained in a month's ordinary sewage. The consequent pollution of the river, when it occurs, is none the less disagreeable or injurious to health, that, after an expenditure of six millions of money, it occurs only at intervals.

2. This plan cannot be carried out without great risk to the health of the inhabitants of the metropolis. "The construction alone of these sewers and their numerous tributary branches," says Dr. Copeland, "must prove a most serious matter to the inhabitants of the streets through which they are carried. The trunks especially must be both deep and large, and, consequently, the quantity of earth saturated with, and rich in the product of, animal decay, through the lapse of centuries, that will be thrown up during these constructions, and exposed to the action of the atmosphere and to the influence of the sun, must be productive of terrestrial emanations, calculated to generate a fatal typhoid epidemic of long continuance. London will be as deeply, more generally, and not less fatally, cut up into trenches than the grounds surrounding Sebastopol." (On the Drainage and Sewage of London and Large Towns.)

3. This plan will create a nuisance rivalling that which it is intended to prevent. The reservoirs, the 18-mile streams of sewage, covered or uncovered, will not smell very sweet.

4. The plan contains no provision for the utilisation of the sewage. It takes away any remaining chance of its being utilised, by diluting it still farther. A velocity of two feet six inches is required in the outfall channels to prevent deposit. This velocity, however, could not be maintained unless the channel were nearly full of water; but the amount of the maximum flow of the sewage during dry weather is not much more than one-sixth of the quantity to be removed during rain. We propose, therefore, to obtain from the Thames at high

water the necessary quantity to fill the outfall channels during those times when the flow of sewage is not sufficient to give the required depth and consequent velocity. —(Report, p. 34.) The sewage which in dry weather is worth, as we have seen, seven farthings per ton, comes, when diluted with six times its bulk of water, to be worth just one farthing per ton, and will continue to flow into the German Ocean.

To sum up, the plan of the Government referees does not ensure the complete purification of the Thames; it leaves the sewers of the metropolis in *statu quo*—that is, in dry weather accumulating deposits of foul organic matter, which the first heavy rain washes into the river as before; it does ensure that the loss of fertilising matter, to the value (as they say) of £1,000,000 sterling per annum, shall continue.

The plan which I have proposed, on the other hand, contains a remedy for both evils—the evil of nuisance, and the evil of waste. The utilisation of the sewage, the purification of the Thames, and the effectual drainage of the metropolis, are all provided for, and—the sewage problem is solved.

I am, &c.,

ALEX. LESLIE.

Turriff, Aberdeenshire.

#### NEW ZEALAND AND ITS RESOURCES.

SIR,—In the discussion on Mr. Stones' paper, given in the *Journal* of last week, I am reported to have said, "The reason why the New Zealand flax had been so little taken up was, from the fact that it came over heckled, and the yellow bark which had a deteriorating effect upon ropes made from it was not got rid of." It should have been, "The reason why New Zealand flax had been so little taken up was, from the fact, that when heckled only, the yellow bark, in a great measure, remained, so that a three-inch rope with the bark-like substance on would only make a two-inch rope if properly cleaned."

I am, &c.,

E. W. TRENT.

Brookby's-walk, Homerton, March 2, 1858.

#### DISEASED BEERS.

SIR,—The above heading having just caught my eye in the *Journal of the Society of Arts*, I may be excused for making a remark or two upon it. The use of the products of sulphur for brewery utensils is by no means a new thing, as I myself used it very largely some 25 years since—that is, diluted sulphuric acid, which was applied to a large quantity of butts about to be taken down, without any certainty as to when they might be required to be put together again. The plan answered thoroughly; but, how far it would be wise or prudent to use, for casks or brewery utensils generally, such a process, must be left to the judgment and taste of those more immediately concerned.

As it is well known that I have given many years' study to the seasoning of all kinds of wood, and brewers' casks as well, I trust I may be excused for saying, as regards the latter, that a rapid current of highly-heated air to the inner surface, according to the plan which met with the "golden" approval of the Society of Arts eight or nine years ago (and which, I may add, has been successfully applied to many millions of casks since that period), is much safer, cleaner, and altogether better than placing in the hands of perhaps careless labourers the use of any such element as that already referred to.

I am, &c.,

ROBERT DAVISON.

8, London-street, City, Feb. 24, 1858.

#### To Correspondents.

The members of the Pottery Mechanics' Institution, Hanley (late Shelton), Staffordshire Potteries, wish it to be notified that

they still agree to an "Interchange of Privileges" with other Institutions.

Mr. Theophilus Heale, of 117, Bishopsgate-street-within, wishes to contradict the statement made by Mr. Stones, in his paper on New Zealand, to the effect that the works at the copper mines of the Great Barrier Island are not being carried on. Mr. Heale states that they have never been suspended for a single day since they were undertaken by himself and Mr. Whitaker in 1851, and that he considers the yield satisfactory.

#### PARLIAMENTARY REPORTS.

##### PRINTED SESSIONAL PAPERS.

Parl. No.

*Delivered on 23rd, 24th, 25th, and 26th February, 1858.*

- 54. Metropolitan Police—Accounts.
- 68. 1. Trade and Navigation—Accounts (31 Jan., 1858).
- 86. East India (North Western Provinces, &c.)—Return.
- 40. Schools (Scotland)—Returns.

#### MEETINGS FOR THE ENSUING WEEK.

- MON. Medical, 5. Anniversary Oration.
- Architects, 8. Rev. J. L. Petit, "Remarks on Byzantine Churches."
- Geographical, 8½.
- TUES. Royal Inst., 3. Prof. Huxley, "On Biology."
- Syro-Egyptian, 7½. Mr. Jos. Bonomi, "On the Identification of certain Musical Instruments represented in the Sculptures of Nineveh, with those mentioned in the 3rd Chapter of Daniel, and in the 150th Psalm."
- Civil Engineers, 8. Renewed Discussion, "On Submerging and Repairing Telegraphic Cables."
- Med. and Chirurg., 8½.
- Zoological, 9.
- WED. Literary Fund, 2. Anniversary.
- Society of Arts, 8. Mr. Henry Ashworth, "On Cotton: its Cultivation, Manufacture, and Uses."
- Geological, 8. I. Mr. Redaway, "Notes on the Gold Fields of Victoria, &c." II. Mr. Phillips, "Notes on the Gold Fields of Southern Australia." III. Mr. A. R. C. Selwyn, "On the Geology of the Gold Fields of Victoria."
- Graphic, 8.
- Archæological Assn., 8½.
- Royal Soc. Lit., 8½.
- THURS. Royal Inst., 3. Prof. Tyndall, "On Heat."
- Royal Society Club, 6.
- Antiquaries, 8.
- Royal, 8½.
- FRI. Astronomical, 8.
- Royal Inst., 8½. Dr. W. B. Carpenter, "On the Lowest (Rizopod) Type of Animal Life, considered in its relations to Physiology, Zoology, and Geology."
- SAT. Royal Inst., 3. Prof. Bloxam, "On the Chemistry of the Elements which circulate in Nature."
- Medical, 8.

#### PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[From Gazette, Feb. 26, 1858.]

*Dated 20th January, 1858.*

- 98. C. Davage and T. Davage, Sheffield—Improvements in railway crossings.

*Dated 28th January, 1858.*

- 152. P. Bussi, 38, Cannon-street—An improved railway carriage. (A com.)

*Dated 6th February, 1858.*

- 223. G. Davies, 1, Serle-street, Lincoln's-inn—Improvements in the preservation of meat and other animal and also vegetable substances. (A com.)

*Dated 9th February, 1858.*

- 244. B. B. Wells, 431, Strand—Improvements in apparatus for counting and indicating numbers.
- 245. R. Carte, 20, Charing-cross—Improvements in clarinets.
- 246. E. Stevens, Cambridge-road—Improvements in machinery for preparing dough, paste, and like articles.

*Dated 10th February, 1858.*

- 249. G. J. Ping, Chard, Somerset—Improvements in machinery for the manufacture of bobbin net and netted fabrics.
- 250. R. Aytoun, Edinburgh—Improvements in safety cages or apparatus for mines.

- 251. W. Palmer, Sutton-street, Clerkenwell—Improvements in lamps.

- 252. J. Chatterton, Devonshire-street, Islington—An improvement in electric telegraph wires, and in insulating telegraph wires.

- 253. J. Nasmyth, Lille, France—Improvements in the mode of obtaining motive power, and of applying it.

*Dated 11th February, 1858.*

- 254. A. Chambers, Canterbury, and W. H. Champion, Lynsted, Kent—Improvements in railway breaks.

255. L. Cass, Bury—Improvements in steam engines and steam engine boilers, and in apparatus connected therewith. (A com.)
256. R. Bell, Gracechurch-street—An improvement in stable pans, sinks, and urinals.
257. G. A. Barrett, W. Exall, and C. J. Andrewes, Reading—An improvement in the manufacture of perforated beaters for thrashing machines.
258. B. Looker, junr., Kingston-on-Thames—Improvements in sockets for receiving telegraphic and other posts or up rights.
260. G. W. Burton, Dubuque, Iowa, U.S.—An improved method of manufacturing white lead. (A com.)
261. J. R. W. Atkinson, Leeds—An improved mode of tightening up an unscrewing binding nuts and screws.
262. W. Keatinge, Merlion-square, Dublin—Improvements in correcting variations in the mariner's compass from local attraction.
263. G. Thorrington, Old Windsor—A novel method of propulsion, applicable to agricultural purposes.

*Dated 12th February, 1858.*

264. W. N. Wilson, 144, High Holborn—Improvements in machines for cleaning and polishing knives. (A com.)
265. W. N. Wilson, 144, High Holborn—Improvements in washing and wringing machines. (A com.)
266. J. C. Fisher and J. Booth, Blackburn—An improved mode or method of driving mule spindles.
267. J. Horsey, Greek-street—An improvement in india rubber and other elastic band or ring fastenings.
268. J. Clifton, New Oxford-street—A new article of nursery furniture or gymnastic exercising chair and support for children. (A com.)
269. T. Neville, Lichfield, and W. S. Dorsett, Aldridge, near Walsall—Improvements in steam boilers or steam generators, and in steam engines.
270. T. Neville, Lichfield, and W. S. Dorsett, Aldridge, near Walsall—A new or improved method of constructing and actuating horizontal water wheels.
271. A. V. Newton, 66, Chancery-lane—An improved construction of sewing machine. (A com.)
272. A. V. Newton, 66, Chancery-lane—Improved machinery for stitching or working button-holes. (A com.)
273. W. C. T. Schaeffer, Stanningley, near Leeds—Improvements in obtaining fatty and oily matters from wash waters, or waters containing soap.
274. J. Macintosh, North Bank, Regent's-park—An improvement in treating articles of gutta percha made or formed in dies or moulds, also certain articles of gutta percha made by expressing through dies, and also articles of gutta percha made by pressing rollers.

*Dated 13th February, 1857.*

276. J. E. Ryffel, Wimbledon—The improvement of stoves, for the purpose of warming rooms and baking bread, called the "hygean stove."
277. J. C. H. Slevier, Upper Holloway—Improvements in submarine conductors of electric telegraphs.
278. E. D. Johnson, Wilmington-square—An improved construction of chronometer case.

*Dated 15th February, 1858.*

279. W. Spence, 50, Chancery-lane—Improvements in telegraphic apparatus. (A com.)
280. J. McDermid and J. McDermid, Oak Tree, Middleton-one-row, near Darlington—An improved apparatus or contrivance for supplying water to buildings and dwelling houses for sanitary purposes, and for the extinction of fire.
281. P. M. N. Benoit, Paris—An improvement in counterbalancing the pressure exerted by the steam against the slide valves of steam engines of all kinds.
282. E. Hunt, Walnut-tree-walk, Lambeth—Improvements in voltaic batteries, and in means for producing the electric light.
283. G. T. Bousfield, Loughborough park, Hixton—Improvements in the preparation of dough for bread, pastry, cake, and other farinaceous articles of food. (A com.)
285. J. Tall, 150, Blackfriars-road—Improvements in that description of carriages called perambulators.
286. M. Crawford, Elswick Iron Works, Newcastle-on-Tyne—An improvement in the manufacture of furnace bars.
287. G. L. Blyth, Derby-street, Parliament street—An improvement in the manufacture of manure from sewage waters and other fluids containing ammonia or nitrogenous matters.

288. W. Cope, Nottingham—Improvements in the manufacture of fabrics by bobbin-net or twist-lace machinery.
289. H. J. Sanders and S. Thacker, Nottingham—Improvements in machinery for the manufacture of textile and looped fabrics.
290. W. E. Newton, 66, Chancery-lane—Improvements in treating certain oils and fats, so as to effect the separation of constituent parts of such oils and fats. (A com.)
291. J. Garnett, Otley—An improved manufacture of paper.

*Dated 16th February, 1858.*

293. H. Wilde, Manchester—Improvements in connecting the ends of lightning conductors, and also the ends of submarine electric telegraph cables.
294. W. Armitage, Manchester—Improvements in looms.
295. T. B. Daft, Liverpool—Improvements in instruments for rubbing out pencil marks and for sharpening pencils.
296. M. A. F. Mennens, 4, South street, Finsbury—Certain improvements in voltaic batteries. (A com.)
297. A. V. Newton, 66, Chancery-lane—Improved apparatus for laying submarine telegraph cables. (A com.)

*Dated 17th February, 1858.*

300. J. E. Boyd, Hither-green, Lewisham—Improvements in lawns and grass mowing machines.
301. G. Baker and J. E. Baker, Birmingham—New or improved machinery for compressing and moulding powders and pastes.
302. P. Heyns, 2, Wades-place, Poplar—Improvements in wheels and axleboxes.
303. R. Varvill, Manchester—A certain improved apparatus for washing clothes or articles of wearing apparel.
304. W. Riddle, 4, Stonefield-terrace, Liverpool-road—Improvements in apparatus for binding and fastening bales and other articles.
305. The Hon. W. H. Yelverton, Whitland Abbey, Carmarthen-shire, and Owen Bowen, Great Queen street, Westminster—An improved manufacture of coke.

#### INVENTIONS WITH COMPLETE SPECIFICATION FILED.

248. W. S. Clark, Atlas Works, Dorset square—Improvements in copying presses. (A com.)—10th February, 1858.
299. C. Monson, Connecticut, U.S.—A new and useful mechanism or apparatus, to be used for supporting one or more gas burners, and conducting gas to such, or for various other useful purposes.—17th February, 1858.

#### WEEKLY LIST OF PATENTS SEALED.

| 26th February.                              |  | 2335. C. J. Duméry.                   |
|---------------------------------------------|--|---------------------------------------|
| 2277. R. Whittam.                           |  | 2479. A. V. Newton.                   |
| 2285. H. Brinsmead.                         |  | 2735. W. Clark.                       |
| 2293. G. W. Lenox.                          |  | 3065. J. de Normann and W. T. Henley. |
| 2296. E. Taylor.                            |  | 3100. J. E. Barton.                   |
| 2299. E. Leigh.                             |  |                                       |
| 2300. T. Hardcastle.                        |  | <i>2nd March.</i>                     |
| 2301. T. W. Roys.                           |  | 2304. G. F. Parnell.                  |
| 2303. J. Petrie.                            |  | 2313. T. Pettijean.                   |
| 2306. T. Jackson.                           |  | 2314. C. W. Ramie.                    |
| 2307. J. R. Atha, W. Pearson, and W. Spurr. |  | 2320. U. Scott.                       |
| 2311. L. Moreau.                            |  | 2322. R. Johnson.                     |
| 2319. J. Nuttall and L. Stean.              |  | 2338. G. J. Mackelcan.                |
| 2327. P. A. le Comte de Fontaine-moreau.    |  | 2360. W. Clark.                       |
| 2328. S. Butler.                            |  | 2362. J. Harrison.                    |
| 2331. T. Goodchild.                         |  | 2380. T. Waterhouse.                  |
|                                             |  | 2392. T. Archer, junr.                |
|                                             |  | 3144. E. Maw.                         |

#### PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

| 22nd February.                                   |  | 26th February.                              |
|--------------------------------------------------|--|---------------------------------------------|
| 400. J. Norton.                                  |  | 422. T. Nash, junr.                         |
| 408. V. J. Lebel, J. Fourniol, and J. B. Remyon. |  | 436. J. Brickles, T. Thorpe, and J. Lillie. |
| 413. J. S. Russell.                              |  | 441. G. M. Miller and J. Wakefield.         |
|                                                  |  | 445. H. C. Jennings.                        |
| 402. W. H. Zahn.                                 |  | 454. G. M. Miller.                          |
| 421. C. H. Roberts.                              |  | 468. J. Coney.                              |
| 547. J. Malcomson, R. Shaw, and W. Horn.         |  |                                             |

#### WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

| No. in the Register. | Date of Registration. | Title.                                                                                           | Proprietors' Name.             | Address.                                                                     |
|----------------------|-----------------------|--------------------------------------------------------------------------------------------------|--------------------------------|------------------------------------------------------------------------------|
| 4060                 | Feb. 22.              | Improved Purse .....                                                                             | Christian Weintraud, jun. .... | { Offenback, in the Maine, Germany, & 4, King-st., Cheapside Bow-lane, City. |
| 4061                 | " 24.                 | A Box for containing Wax or other Matches                                                        | Bell and Black .....           |                                                                              |
| 4062                 | " 26.                 | { Self-acting Lever for removing Cartridges when fired from Breech-loading Guns and Rifles ..... | Joseph Lang .....              |                                                                              |
| 4063                 | March 1.              | Improved Swing Kettle Stand .....                                                                | Thomas Pettiver .....          | 22, Cockspur-street, Charing-cross.                                          |
|                      |                       |                                                                                                  |                                | Trinity-street, Islington.                                                   |